# THE VEDIC BIG BANG

A New Cosmology Scenario
Revealed in the
Ancient Veda Mantras of India

VOL 1

Shiv R. Pal PhD (Physics)


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VOL 2


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VOL 1

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## VOLUME 1
## (Chapters 1 to 5)

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# Table of Contents
# VOLUME 1

**About VOLUME 2**
**Preface to the Vedic Big Bang**
**Acknowledgements**
**CHAPTER 1: Introduction to the Vedic Big Bang**
Concept of Nature, Time, Space and Big Bang are Ancient
Time-entity in Vedic Literature
Space - entity in Vedic Literature
Rotating and Expanding Universe – an Ancient Vedic Thought
The Vedic Earth - a Sphere, in Motion, Not the Center of the Universe
Earth's Gravitation - a Vedic Concept
Hawking's Story of the Elderly Lady and her Earth - Tortoise Theory – How myths get Created!
Hawking and the Universe Out of Nothing - Contradicts the Saankhya Philosophy
Hawking, Grand Design and the Veda Mantra

The Karma Principle
**CHAPTER 2: Present Understanding of the Universe – A Critical Scrutiny of the Contemporary Big Bang Hypothesis**
Developments in Contemporary Cosmology
Clockwork Universe Theory of Newton
Newton's Law of Universal Gravitation:
Immeasurability of an Entity
Fast Particles – Photon and the *Munn* (Mind-entity)
The Five Principles of Modern Cosmology
The Contemporary Big Bang Hypothesis
The Vedic Perspective on Force Transfer
Dark Matter and Dark Matter Mystery
Dark Energy / Vacuum Energy
A Vedic Perspective – No Dark Energy Needed
Deficiencies in Big Bang Hypothesis
Dark Matter/Dark Energy Problem
(2). Matter Speeds in Cosmic Inflation and Quark Lepton Eras – A Puzzle
Other Modern Cosmology Theories
Author's Queries and Deductions from Modern Cosmology

**CHAPTER 3: The Historicity of Vedic References The References on Cosmology Precede 5,000 years**
Proof of the Vedic Reference Hypothesis
Genealogy of Aryan Kings in the Lunar Dynasty: Pre-Yudhishthir Era
Time-Milestone at February 18, 3102 BCE
*Kali-Yuga* onset and the Planetary Conjunction
History-Keeping in Aryan Calendars
Christian Calendar Discrepancy
Defunct Aryan Hypothesis (AH) and Aryan Invasion Theory (AIT)
India – The Aryavart According to King Manu
The Scientific Proof of Extinct Legendary River Sarasvati
Vedic Civilization at the Shores of River Sarasvati
A Remarkable Discovery from Manusmriti
The Blackbuck of Aryavart
Astronomy and Age of the Vedas

Historical Records and Validation of Timeline-A
(1). 300-400 BCE: Megasthenes on Krishn, Validation of Time-milestone-4 on Timeline-A
(2). The Case of Rajtarangini – A Book of Ancient History
(3). Ancient History from the Book of Satyarth Prakash
(4). Aadi Shankaracharya at Milestone-6 on Timeline-A
Calendar Relationship in Sharda Matha Data
Genetic Research under National Genome Projects
**CHAPTER 4: A Brief Review of Ancient Vedic Literature - the Source of References on Cosmology**
The Vedas
Sanskrit: A Language with the Scientific Structure
The Branches of Vedic Literature
Oral and Writing Traditions of the Aryans
Record-keeping and History Writing in Ancient India
Vedic Principle for the Age of the Vedas
Max Muller et al Credited and Discredited
**CHAPTER 5: The Primary Vedic Entities in the Creation of the Universe**
Vedic Terms in Cosmology
The Five Eternal Entities of Vedic Creation
(1). The Creator-Entity (*Purush-tatva*)
(2). The Nature-entity (*Prakriti-tatva*)
*Aapah* the Viscosity of Space
(3). The Soul-entity (*Atm-tatva*)
(4) Time-Entity (*Kaalah-Tatva*)
Measure of Time-entity: Large Time Scale of the Aryans
*Manvantar* Period and the Big Flood
Time-keeping by the Aryans
The Mind-Boggling Case of *Nimesh* (निमेष): the unit of time
(5) The Space-entity (*Aakaash-tatva*)
*Antariksh* - the Vedic Space is Curved
The Case of Vedic *Usha*: the Morning Twilight
The Mind-boggling Case of Space -Time Relationship: the Speed of Light in the Vedic Literature
**Index**
**References/Citations**

**Limited List of Vedic Terms often cited in the Book**
**About the Book**
**About the Author**

# About VOLUME 2

The book is in two parts, VOLUME 1 (430 pages) and VOLUME 2 (340 pages). The Chapters 1 to 5 comprise the VOLUME 1 and the Chapters 6 to 11 are in VOLUME 2.

The Chapter 5 of VOLUME 1 presents the unprecedented definitions of entities and processes that serve as the cause and effect for the advent and formation of the Vedic universe and prepares the stage for this author to formulate the "Vedic Cosmology Principle" in Chapter 6 in VOLUME 2.

The "Vedic Cosmology Principle" is based on 12 RigVeda mantras from its "*Bhavavrittam" suktas* (hymns) and 5 *shloka-couplets* from the ancient book of Manusmriti's first chapter, entitled the "*Srishti Utpatti*". These mantra references lead to 28 physics deductions. The RigVedic term "*Bhavavrittam*" (discussed in Chapter 6) means "*The History of Creation of the Universe*" or "*A description of the Birth of the Universe*" and the term "*Srishti Utpatti*" means "*The Birth of the Creation* (universe)". Supplementing the 28 deductions in physics with 40 additional Veda mantra references, the author has developed the "Vedic Cosmology Scenario" in Chapters 7 to 10 in VOLUME 2.

The Chapter 11 presents numerous intriguing facts and features pertaining to the Vedic formation of the solar system including the birth of the Earth and the other planets. The VOLUME 2 is embellished with colour

graphics delineating the stages of the primordial matter-ovate, first in the incubation period of 4.32 million years, developing “heat” and “rotation” and then exploding into uncountable matter-ovates forming the universe and the solar system. The titles of the six Chapters in VOLUME 2 are as following.

## Chapter Headings of VOLUME 2

CHAPTER 6: The Vedic Cosmology Principle……403
CHAPTER 7: The Energy Forms in the Vedic Big Bang Scenario...…… .....…455
CHAPTER 8: First Action of Aditi (Nature) - the Creation of the Eight Progeny of Aditi…….. 485
CHAPTER 9: Heat Energy Eh and Rotational Energy Er are the Fundamental Tools of Creation…….....……513
CHAPTER 10: The Vedic Pralaya is the Big ……..595
CHAPTER 11: Functioning Vedic Universe – Birth of the Solar System and the Ancient Observations of the Sun and the Planets….....611

To
my wife and our son - my best friends.

# Preface to the Vedic Big Bang

Professor Carl Edward Sagan in his writings and in the famous TV series, 'The Cosmos', praised ancient Vedic thought on cosmology. He recited the English translation of a Veda mantra and remarked, '*most sophisticated ancient cosmological ideas came from India*'. I have attempted to bring together the advanced, intriguing cosmological ideas from a large number of the ancient Veda mantras that lay the foundation for a Vedic Cosmology Scenario for the formation of the universe. My humble effort would further strengthen Carl Sagan's enunciation. Of the wide range of subject areas covered in the Vedas, the emphasis in my book has been restrained to invoking the mantras relevant to physics and the Vedic Cosmology Principle that reveal the process of the formation of the universe. All this hidden knowledge permeates the ancient Veda mantras.

When I began writing this book in 2008 there were no modern books addressing Vedic Cosmology from a physics perspective. It took me many years of intense Vedic research and cosmological analysis to complete this book entitled "The Vedic Big Bang". I therefore chose thorough, comprehensiveness rather than speed of publishing.

This author (Shiv R. Pal) named the Vedic creation process "The Vedic Big Bang"© because it sets forth the birth of the universe out of an impetuous explosion in the enormous primordial ovate of brilliantly hot matter named हिरण्मयमाण्डं (*hiranmayam-aandam*) the literal meaning of which is – "the golden-embryo" or "the ovate/spheroid with hot golden brilliance". There are several similarities and numerous differences between the ancient Vedic Cosmology Principle developed in Chapter 6 and the Big Bang Hypothesis in modern cosmology; both separated by a time-gap ranging in millennia.

An overview of the status of contemporary cosmology with an emphasis on the Big Bang Hypothesis is presented in Chapter 2 in simple terminology at the level of a general reader. This author raises numerous questions on the enormity of the explosion in a dimensionless point called the 'space-time singularity' at infinitely high temperature. The 'universe

out of nothing' from the dimensionless space-time singularity is counter intuitive and in violation of the simple logic affirmed by the ancient sutra (1/43) - नावस्तुनो वस्तुसिध्दिः (*Naavastuno vastusiddhi*) of Rishi Kapil's Saankhya Darshan (Philosophy) which means - "*Nothingness cannot be the cause of something*". The contrasting Vedic Big Bang mechanism uses the pre-existing indefinable *Asata*-state of matter (Nature) as the "material-cause" of the real definable *Sata*-state of matter that forms the universe. The universe is the ensuing 'effect' of the pre-existent "material-cause". The Vedic Big Bang is 'something out of something'. This book presents a new perspective on the deficiencies of the modern Big Bang Hypothesis including the mathematical exercise in the hypothetical Cosmic Inflation to accelerate the universe and the un-harnessable Dark Energy to expand it. One of the Big Bang theory's creators, Paul J. Steinhardt of Princeton University (USA) stated (Scientific American, April, 2011) – *"....But some of the theory's creators ....are having second thoughts. As the original theory has developed, cracks have appeared in its logical foundations....."*

The Vedic Big Bang Scenario in Chapters 7 to 9 is not translated into a mathematical framework, however, this Veda-based qualitative scenario works with real physical entities, real physics processes and the real by-products of matter and energy, including the force responsible for the expansion of the universe (discussed in Chapters 8 and 9) unlike the hypothetical Dark Energy in modern cosmology. Developing a mathematical model of the Vedic Big Bang would be straightforward when taken up.

This author, a physicist by training, found in his Vedic studies a treasure-trove of mantras laden with the principles and mechanisms pertaining to the advent of the universe and also found thoughts rich in the cognate subjects including physics, cosmology and astronomy. The four Vedas: RigVeda, YajurVeda, SaamVeda, AtharvaVeda, known as "*the books of knowledge of the Aryans***", are the fountain-head of the mantras. Sanskrit, a language with perfect grammar, is the language of the Vedas and the subsequent Vedic Literature. Each term (word) in Sanskrit is a derivative of a root or roots, the etymological analysis of which yields the meaning of the term and reveals the properties and nature of the entity the term stands for. The term "*arya*" originates from the Veda. In spiritual context it means the *eeshwar-putra* (progeny of God) and in the social context it means "*a person with noble qualities*". From ancient times the

inhabitants of the Indian sub-continent have been known as 'Arya' and the sub-continent has been known as 'Aryavart' (the place of the Aryans**). The term Hindus for the Aryans of India and the term Hindustan for Aryavart is a later identification owing to invaders from outside India.

Utilizing the vast Sanskrit vocabulary the Vedas are composed in mantra formulations in unique and mathematically perfect metered poetry. That itself is mind-boggling. The RigVeda alone has 10,521 mantras in it, grouped into 1,028 *suktas* (hymns or sections) with 209 *devatas* (subjects) credited to 354 *rishis* (sages), among whom are 21 *rishikas*, the female *rishis* (Ved Shastra Talika, by Pundit Jiyalal Varma, 1958).

Based on 12 RigVeda mantras from the "*Bhavavrittam" sukta* and 5 *shlokas* of Manusmriti from its first chapter on "Birth of the Universe", this author (Shiv R. Pal) developed the "Vedic Cosmology Principle" in Chapter 6. From these mantra references, the author draws 28 physics deductions. These deductions with the additional 40 mantra references enabled developing the Vedic Cosmology Scenario in Chapters 7 through 10. The rishi (sage) appropriately entitled the RigVeda *sukta* (hymn) as the '*Bhavavrittam*' because the term (discussed in Chapter 6) means "*The History of Creation of the Universe*" or "*A description of the Birth of the Universe*".

This author has further strengthened the foundation of this unusual book on ancient cosmology by complementing the mantra references with the sutras and statements from the precious ancient Vedic Literature (Darshans, Smritis, Upanishads, Brahmana books and so on); all anterior to a time-milestone on February 18, 3102 BCE. The book presents the etymology of the important terms in Vedic cosmology, leading to the fundamental definitions of entities serving as a 'cause' in the formation of the universe.

The author takes several steps for translating mantras from Sanskrit to English. A mantra is first presented in Devnagari script (the name of the Sanskrit script) followed by its transliteration. After separating conjugated words, all the words of the mantra are listed with etymological root-based *yaugik* meanings, keeping in mind the context of the *sukta* (hymn) and the mantra. Then, following the instructions emphasized by Swami Dayanand Sarasvati (1825-1883 CE) in his interpretive translation of RigVeda and YajurVeda in the Hindi language and the etymology of terms in the book of Nirukt by Rishi Yask, this author presents the composite mantra translation

in English. All Sanskrit terms in the book are italicized. The Vedas being theistic, at times the mantra gives credit to the "efficient-cause", the Creator, for a physical phenomenon in the "material-cause", the Nature. This is reflected in the mantra translation. However, even if the Creator is separated from the subject matter of the mantra, the valuable physics lesson of the mantra still persists.

The major participating entities in the Vedic creation process of the universe such as Time (*Kaalah*), Space (*Antariksh*), Nature (*Prakriti*) and so on, including the definition of the fundamental building-block of *Prakriti* (Nature), the smallest unit of matter termed as *parmaanu*, are all defined with clarity. The Nature in the Vedas is an inert entity without the virtue of inspiration to create. It is the entire matter/energy of the universe; the universe is the Nature. The Nature in Vedic physics, at its most fundamental level is divided into a triplet of fundamental particles named *sata, raja* and *tama* with diverse properties. All definitions are in Chapter 5.

The abstract entities, Time (*Kaal*) and Space (*Aakaash*), are thought to be real entities in the Vedic Cosmology, same as in the modern Big Bang cosmology. The difference is that these entities in Vedic Cosmology are eternal in nature through the perennial cycle of creation-dissolution of the universe whereas in the modern Big Bang Hypothesis they are said to be first-time created at the time-zero of the Big Bang. They are used in the Big Bang algorithm but are least defined or not defined in terms of what they actually are, what mechanism created them with what ingredients and what is at their fundamental structure.

A general principle in Vedic Philosophy stipulates that all created entities are quantized at their fundamental level. Therefore, the onus is on the modern Big Bang Hypothesis to define the entity being used. The mantra formulations in Vedic Cosmology render considerable commentary on the nature of these entities (discussed in Chapters 1 and 5, Volume 1). The entities such as the Time (*Kaal*) and the Space (*Aakaash*) are common to the two cosmologies; however, one finds that their Vedic definitions are superior in uniqueness and depth to the definitions available from the modern cosmology. The large number of Vedic synonyms for these entities represent their specific properties and add to our understanding of the uniqueness of these entities. The specificity in a Vedic thought at times is mind-boggling. It is mind-boggling to read in the RigVeda mantra (10/56/5) that the universe is expanding. The full mantra is in Chapter 9 in Volume 2,

however when one reads that the universe with "*…its self-propelling force expands greatly the celestial objects from their minimum positions ….in togetherness ….*" one has no choice but to put such mantras into the physics frame of reference. In the Vedic mechanism the force of expansion is real and not hypothetical as the un-harnessable Dark Energy of modern cosmology.

The Sanskrit term for the advent of the universe is *'srishti'*. The closest term for 'srishti' is 'creation'; the etymological analysis signifies that the term 'srishti' has no religious connotation and stands for the advent of the universe with all the substances created in it, animate and inanimate. It has no relation to the creationist-argument. Implicit in the term '*srishti*' however is that "*the universe is not an ever-existing phenomenon, it has come to be at a given point in time*" and its active state of matter during the creation phase will dissolve into an inactive state leading to its non-creation phase termed as '*pralaya*'. In the Vedic thought the *'srishti'* and '*pralaya*' are part of the eternal cycle with long-term frequency; they are the day and night of the creation-dissolution process.

To prove that the Veda mantras and the sutras of Darshans are extremely ancient and were not influenced by the modern thought and by the thoughts of other known ancient civilizations the author postulated a 'Reference Hypothesis' in Chapter 3 stating, "***The Vedic references on cosmology are ancient and precede the 5,000-year period***". The hypothesis is proven by establishing a realistic timeline deduced from the historicity of Vedic Literature and validated by the ancient records available even today in three different calendars that have been in active use since India's distant past.

The antiquity of the Vedic references used in this book takes one anterior to the time-milestone at February 18, 3102 BCE, which was not established by a common calendar initiated at the coronation of a king or introduced after a famous person in history but it marked the onset of a calendar that is concomitant with astronomy. This date in the Common Era Calendar is the onset of the Vedic sub-Calendar called the Kaliyug-Calendar within the Vedic Srishti-Calendar (long-term Natural Vedic Calendar).

This book provides a glimpse into the ancient Vedic civilization in India going past 5,000 years. The overview of the Vedic Literature in Chapter 4 exhibits its richness. The religion, science and philosophy go

hand-in-hand with the concept of the form-less unitary all-pervading consciousness *Brahmn* as the Creator, with the inert *Prakriti* (Nature) serving as the material-cause of the universe. In addition to the conterminous Creator and the quantized Nature, the universe is also populated with the quantized units of consciousness called the *aatmas* (souls) whose interaction with matter is observable in the living-beings bound by the principle of free-will, karma and the system of re-birth.

The brief historical overview of the Vedic Civilization presented in Chapter 3 begins with the kings of the Sun Dynasty in the distant past of the time-milestone in 3102 BCE who ruled from Ayodhya including King Ram. The kings from the Moon Dynasty ruled from Hastinapur (Delhi). This book gives information about the years, months and days of rule of each king in the Lunar Dynasty, starting from the coronation of the King Yudhishthir in 3140 BCE after the great war of Mahabharata. The Aryan dynasty at Hastinapur continued till 1191 CE when the last Aryan King Yash Pal was forcibly replaced by a Moslem invader from outside India. Parallel to Yudhishthir dynasty was the Nand dynasty of Kashmir kings. The historical account is compiled in the book entitled "Raj Tarangini" written in 1148 CE by the court historian Kalhan. The remarkable continuity in the succession order of the head-priests at Shankaracharya monasteries, beginning in October 492 BCE, is available in three different ancient Indian calendars up to date. These data provide the proof for the Reference Hypothesis stated above.

Max Muller and the other Western Indologists of the nineteenth century, who translated the Veda from Sanskrit to English, arbitrarily shrank and distorted the ancient history of India without providing a solid reference in support. This assault did not spare even the Vedas and the Vedic Literature. That erroneous history is still being taught by the contemporary scholars. Therefore, the Chapters 3 and 4 in Volume 1 of this book are critical of Max Muller. His inadequate preparation in the Sanskrit language and grammar and his bizarre mistranslations of the RigVeda mantras are pointed out. The writings of Max Muller's contemporary Swami Dayanand Sarasvati and Pundit Gurudatta Vidyarthi, the great scholars of Sanskrit, are invoked to point out erroneous mantra translations by Max Muller and others. To disprove Max Muller's Aryan Hypothesis and the Aryan Invasion Theory, the author has tied some historical loose ends invoking the state-of-the-art data from satellite and ground-truthing instrumentation

under the "Extinct Sarasvati River Project" and the national genome projects of the Government of India.

Sooner or later this unique book was to happen because when a contemporary physicist (like this author) reads in Rishi Kanaad's ancient Vaisheshik Darshan *sutra* (5/2/3) - अपां संयोगाभावे गुरुत्वात् पतनम् (*Apaam sanyog abhaave gurutvaat patnam*.), which means - "*The rain drops in the absence of the union (with air) fall down due to* ***gurutva*** (gravitation)", this author has to let the underlying fact be known to all, that the knowledge of gravitation (***gurutva***) is far more ancient than 1666 AD when Newton may have seen the apple fall from a tree. The inescapable fact is that Rishi Kanaad's statement on gravity is neither a fortuitous one nor a fleeting one because, to explain the intended phenomenon of gravitation at a deeper level of inquiry, he took up two other examples from the daily life, exhibiting the effect of gravity. The first example was that of a *moosal* (heavy pestle) falling in the *okhal* (mortar) under gravity (5/1/7) when released by hand. The second example was that of an arrow in-flight with the additional force imparted to it by the string of the bow, falling gradually under gravity (5/1/16, 17, 18). He also emphasized gravity as the अदृष्टकारितम् (*adrishtkaaritam*, 5/2/1, 5/2/2) of the Earth, the invisible action (karma) of the Earth, an erudite deduction indeed!

The Vedas are not just focused on cosmology. They deal with considerable astronomy beginning with the mantras on the formation of the solar system (Chapter 11) and the meaningful naming of the 28 constellations and 9 planets; the Earth and the Moon included. The Vedic prescribed solar system formation is quite similar to one of the modern theories of the formation of the solar system. The *rishis* had developed tremendous insight into the characteristics and orbital motions of planets. They named Jupiter as *Guru*, meaning *'the largest'* and Saturn as *Shani* – meaning '*the slow-moving'*. The seven rays of the Sun are given seven distinct names and the Sun is designated as the controller of the solar system. Considerable discussion is presented on the Sun, the Earth and the Moon. The mantras state that the Earth and the planets orbit around the Sun and the Earth is round and not the centre of the universe. A mysterious statement in the Mantra Brahmana (1/5/13) states - '*That black substance on the surface of the Moon is there from the interior (heart) of the Earth'*. It is astonishing that the modern astronomy has not yet suggested the Earth's interior as the source of the black-maria regions of the Moon,

predominantly on its front surface facing the Earth. Based on the age estimates of the lunar samples, this author has explained the possibility of the veracity of the Mantra Brahmana statement.

When a Veda mantra assigns a definite period of 4.32 million years for the primordial matter-conglomerate of the universe in the ovate shape (*Hiranmaya-aandam*) to have developed tremendous heat energy and rotational momentum before it exploded (Big Bang) creating *koti-koti* (hyperbole for uncountable) smaller *aandams* (ovates), which are said to be the cause for the *mahaan* (great) celestial bodies, a physicist cannot label such a mantra as the byproduct of faith. The number 4.32 MY being in cosmological scale and associated with the raw material of the universe in the shape of a brilliantly hot spheroid (*Hiranya-aand*), he has no choice but to put the mantra into the physics realm. The mantra thus is a part of the Vedic Cosmology Scenario.

# Mind-boggling Cases in Vedic Physics

In the development of the Vedic Big Bang Scenario several deductions are drawn. It makes one wonder how the *rishis* (sages) of the Veda mantras reached such conclusions in physics, so long ago. Of the numerous mind-boggling cases found in the Vedas and discussed in this book, two are cited here that have strong relationship to physics.

Rishi King Manu in his book entitled Manusmriti has divided the time-scale from the largest time-unit of 4.32 billion years to the smallest time-unit of *nimesh* (178 milliseconds). A *nimesh* being the blink-time of a human eye, Manu could not have derived this unit without a rigorous experiment in human physiology and an accurate time measuring methodology. The state-of-the-art blink-time measuring experiments carried out by other researchers (discussion in main text) with computerized timing with the optical imaging system, provided the average blink-time of a normal human eye to be 175 milliseconds. This is very close to Manu's definition of *nimesh* measuring 178 milliseconds. This is not an ordinary result.

The RigVeda mantra (1/123/8) states that the distance of morning twilight illumination due west of the sunrise point is 30 *yojan* (390 km). This is mind-boggling because using the ray-tracing geometry and knowing that the troposphere contributes to twilight, one finds that 390 km is highly accurate (details in Chapter 5). It is mind-boggling because it could not have been determined without the *rishi* having the knowledge of the daily spin rate of the Earth and its circumference and radius. These cases are amazing because all this took place anterior to the time-milestone at 3140 BCE!

**Shiv Raj Pal**

# Acknowledgements

Acknowledgement by an author of a book is generally about expressing indebtedness to those who have played a role, directly or remotely, in helping to enhance the substance of the book. About indebtedness, the ancient commentary book on YajurVeda, the Shatpath Brahmana states (1/7/2/1), - "Soon *as a human-being is born he/she is indebted to the devas, rishis (sages), pitars and the other humans of the society*". The *devas* in this context are the inert physical systems of Nature, that are essential for sustaining the universe and 'selflessly' enabling the living creation in it. Just by the virtue of taking birth in this creation a human-being becomes indebted to Nature (*devas*). The Veda advises humans to become conscious of the environment and refrain from misusing and harming the Nature's systems. Conserving Nature's resources and minimizing wastage are the payments towards the debt the humans owe the *devas*.

Humans are indebted to the *rishis* (sages) who selflessly impart Vedic knowledge through the Veda mantra formulations. This author is indebted to the Vedic *rishis* for the mantra formulations in the four Vedas and the *sutras* in the Darshans (Philosophies), Upanishads and Smritis that form the basis for the physics and cosmology in this book. The author is especially grateful to Rishi Swami Dayanand Sarasvati (1825-1883 CE), the great scholar of Vedas and the Vedic Literature who revived the interest in the Vedas and gave an impetus to the society to be proud of the Vedas and the Vedic knowledge. He emphasized to use the right tools of grammar and methodology for understanding, translating and interpreting the Veda mantras. The author has benefitted immensely from his Veda translations in the Hindi language and his guidance for unravelling the meanings of the mantras using the '*science of word formation*' in Rishi Panini's *Ashtaddhyaayi* grammar and the ancient etymology of Vedic terms in Rishi Yask's Nirukt and Nighantu. Utilizing the Veda mantra references this author has become increasingly aware of the irredeemable debt that he owes to the Vedic *rishis*.

The author wishes to express his gratitude to the late Pundit Jiyalal Varma of Kota, Rajasthan, the author of a Vedic resource book entitled

"Ved Shastra Talika" ("A Key to Vedas and Philosophy") who was a mentor to this author for the Vedic knowledge. Pundit Jiyalal ji discussed with the author the intricate concepts of Vedic Philosophy when the author was of an impressionable age during his school, college and university years while pursuing education in physics. In 1961 Pundit Jiyalal ji from his large book collection gifted to this author a book entitled "Ved Vidya Nidarshan" written in 1959 by Pundit Bhagvaddatta and asked this author to read the book and explore the science thought in the Vedas. The author cherishes this inspiring book and has referred to it in several places in this book.

The author is grateful to Acharya Udayaveer Shastri (1894-1991 CE), a great Vedic philosopher of our times, a great Vedic historian and a scholar of Sanskrit language, with a large number of books to his credit, for his interpretations of the mantras and the *sutras*. Referring to the historical data arduously researched and presented by Acharya Udayaveer Shastri in his remarkable book entitled "Vedant Darshan Ka Itihaas" (History of the Vedanta Darshan, 1991) has tied some historical loose-ends for this author's "Reference Hypothesis" (in Chapter 3). Deep gratitude is expressed to the late Acharya Gyaneshvar ji of the Vanprasth Ashram of Rojad, Gujarat, who generously gave his time for discussions on Vedic topics.

Humans are indebted to the *pitars* (parents and forefathers) because they contributed to establishing a civilized society. Under the Vedic karma principle and the rebirth system one is considered to be blessed if one takes birth from 'good parents and in highly developed society'. My parents are the *pitars* who followed their *dharma* towards the society they were born into and brought up the next generation with their best effort, responsibly. I am indebted to my late parents.

Even though my parents were unsophisticated village folks with education at a basic reading-writing level, they had high reverence for education. Not having a school in my small farming village and discovering that I had the potential for acquiring higher education, my parents left no stone unturned to walk me to a school wherever possible in the countryside even during monsoon rains and hot summers. Poverty did not stop my determined parents to send me to the city for education at the primary and middle-school levels. The well-deserved educational scholarships and the small income from the private tuitions that I offered in the community, made my continued education viable, unburdening my parents from the financial strain.

I am deeply grateful to my parents for inculcating the values and the discipline that took me forward, step by step, through successes and setbacks. Their words of wisdom disguised in the form of a simple 'village-saying' or an ancient proverb have left an imprint on my inner-self and the same words echoed different meanings under differing circumstances of life. When I was small and walked by my father's side he told me: "*Shiv, there are two possible benefits of looking at the ground ahead of you while walking rather than looking at the sky; you may find a rupee* (money) *and you will never step on a snake*". Their simple words of wisdom always had a much deeper meaning. I will remain indebted to my parents.

My wife, a Ph.D. from the University of Toronto, a Special Educationist, kindly accepted my request to edit the manuscript. A talented singer with the music degree of Sangeet Visharad in North Indian Classical Music, with three albums to her credit, she is generous with her time and teaches meditational music on a voluntary basis at a charitable cultural institution. With her busy schedule she devoted valuable time to help refine the manuscript. I am grateful to her for spending uncountable hours on editing and for continuing to be a tower of strength for the family.

After retiring from research in physics, I spent considerable time on the studies of the Vedas and Vedic Literature. Based on my notes I prepared several public lectures and discourses. Our son helped me with the logistics of the presentations. He encouraged me to compile the Vedic ideas and the copious notes into this book. I am grateful to him for his persistent encouragement which led me to write this book. He has closely followed the progress of the book and was always helpful in resolving any technical difficulties. He has been a steadfast friend through all the challenges that I faced.

**Shiv R. Pal**

कालो ह भूतं भव्यं च पुत्रो अजनयत् पुरा ।...

(*"Kaalo ha bhootam bhavyam cha putro ajanyat pura"….*)

*" Time (Kaal) the son is its own father* (the past) *and will be born as its own son* (the future)"….

(AtharvaVeda, 19/54/3).

# CHAPTER 1: Introduction to the Vedic Big Bang

*"...few of us spend much time wondering why nature is the way it is; where the cosmos came from, or whether it was always here; if time will one day flow backward and effect precede causes; or whether there are ultimate limits to what humans can know…and why there is a universe."* (From Carl Edward Sagan's introduction to "A Brief History of Time" by Stephen Hawking).

The queries, such as in Sagan's quotation, -*...why nature is the way it is; where the cosmos came from…. if time will one day flow backward…"* are certainly not recent products of the human mind. Owing to the overwhelming developments in science and technology of the modern era, the tendency is to think that such queries, if raised in previous civilizations, must have remained at a primitive level. However, the documented facts preserved in the ancient Vedic Literature suggest that such queries are millennia upon millennia old and they were dealt with the thought system that was highly advanced.

If one raises the blind on the window of the present civilization and makes an attempt to take a peek upstream at the other shore of the unidirectional 'river of time' one will witness much more going on there than just the indulgence in the primitive queries about the universe. If one were to make a sincere effort in focusing on the blur of the distant past, one would find that there is an early civilization there which uniquely owns an abundance of well-focused thoughts in science and philosophy. The added excellence associated with this ownership is that these ancient thoughts are well-documented, well-preserved in their originality and available to the present civilization. These thoughts are not expressed in a primitive language either; instead they are well-articulated in amazing and unique poetry formulations with mathematically precise metered scales, in a most

sophisticated language that is rich in vocabulary and grammar. This language is Sanskrit. It is the language of the four Vedas, '*the sacred books of the Aryans* (*Hindus)*. These extraordinary Vedic thoughts in mantra formulations are preserved unadulterated, without even a slight change of a syllable since they were first generated in the minds of the *rishis* (sages) in the distant past of the Vedic Aryan Civilization of India. The remarkable feature of this civilization is that it is not just a few thousand years old but it embodies unknown multitudes of eons from the far antiquity. Sanskrit continued to be the language of the vast post-Vedic literature that expounded the thoughts contained in the Veda mantras, which laid the foundation for a high level of spirituality, philosophy and the knowledge-base covering different realms of human development, including the science of the cosmos.

Contemporary linguists and literary scholars have distinguished Sanskrit to be the most ancient and the 'mother of all modern languages'. It is said to be the language of literature that is the oldest in the human library. Sanskrit for the Hindus (Aryans of India) is an endowment from the ancient *rishis* and is revered as the perfect *vaigjyanic bhasha* (scientific language) to express *vigjyan* (science). A NASA scientist, Rick Briggs (at Roacs, NASA Ames Research Center, Moffet Field, California) has expressed the same opinion differently in an article published in the Artificial Intelligence Magazine (Vol. 6, No.1, Spring 1985). He stated:

"*… Understandably, there is a widespread belief that natural languages are unsuitable for the transmission of many ideas that artificial languages can render with great precision and mathematical rigor.*

*But this dichotomy, which has served as a premise underlying much work in the areas of linguistics and artificial intelligence, is a false one. There is at least one language, Sanskrit, which for the duration of almost 1,000 years was a living spoken language with a considerable literature of its own. Besides works of literary value, there was a long philosophical and grammatical tradition that has continued to exist with undiminished vigor until the present century. Among the accomplishments of the grammarians can be reckoned a method for paraphrasing Sanskrit in a manner that is*

*identical not only in essence but in form with current work in Artificial Intelligence. This article demonstrates that a natural language can serve as an artificial language also, and that much work in AI* (Artificial Intelligence) *has been reinventing a wheel millennia old…."*

A natural deduction from what has been stated above is that if the Vedic people developed a perfect language with superiority over other languages, they must have expressed thoughts in that language on different subjects that should have some value even today. The science thoughts on nature and cosmology are of direct relevance to this book. The queries and questions on the universe, similar to those in Sagan's statement, have been raised in the Veda mantras and the answers are also furnished in the form of the mantra formulations. These queries are not just fleetingly mentioned in the Vedas; they are deliberately grouped under chapters and sections with well stated subject headings that cover various aspects of the universe from its inception to its establishment and functioning. There is positive affirmation in the mantras that the queries are not left at the level of mere verbalization but the answers are sought through serious thought process. The most fascinating aspect of the queries and answers in the Vedas is that they being the product of the far antiquity of human civilization were not influenced by the present age of science and philosophy which commenced only a few eons ago. Carl Sagan has elegantly put forth the un-aging queries, touching the areas of physics, astronomy, cosmology, philosophy and even spirituality, all in one sentence quoted above. Regarding Vedic thought, Sagan in his writings had expressed that "*most sophisticated ancient cosmological ideas came from India"*.

The other name for the matter and energy of the universe spread out in all directions in the form of effulgent cosmos is Nature. Cosmology is the science of cosmos. The matter of the universe is seen and detected in its subsistent and non-subsistent, observable and non-observable matter and energy forms. On a grand scale of things the Nature is not alone by itself; it is embedded in a real entity called Time, the entity that Sagan in the above quote is also talking about. It is an invisible non-subsistent entity that is not a form of energy, not a part of the matter of the universe and is not created by the matter of the universe. Among his queries Sagan has not included yet another real entity called Space, which according to its Vedic definition also

pervades through the universe encompassing even the biggest celestial objects and penetrates through each minutest of minute matter particle of Nature. The Space by the Vedic definition spreads out up to the edge of the universe, wherever that edge might be. As expressed in a Vedic expression - *the Space serves as an overall container of the entire universe*. A common container is outside the matter it contains such as a glass around a volume of water. But, the Space entity of the Vedas is a unique container - it is outside the matter it contains as well as it permeates through the matter that it contains. That the Space is an entity, that it is curved and that all objects are embedded in it is also a concept in modern Big Bang cosmology, however, it is not thought to be permeating inside matter. The Space in Vedic cosmology, like Time, is also an invisible non-subsistent entity which is not created out of matter or energy and it is not created out of Time either.

To answer questions such as – when, how and *where the cosmos came from*, the cosmologists resort to explaining matter (Nature) and its behaviour. They soon find out that the universe cannot be created by matter (Nature) alone; the Time and Space entities are also needed. The Time-entity is needed to create the universe in and the Space-entity is needed to put the created universe in. The irony is that the modern Big Bang cosmology is not able to explain how these two entities were created in the first place. Modern cosmologists are certain on the advent of this beautiful universe at a given point in its distant past but are not certain on whether the Nature itself pre-existed before that distant past. In this regard, this author could add a few more queries to Sagan's list: did the Nature pre-exist before the beginning of the universe or is the present universe its first birth, did the Time and Space pre-exist or were they born for the first time along with Nature, if they were born for the first time what necessitated their birth, what are they made of, what mechanism caused them and why are they different from each other and from Nature itself? The reader may find it interesting to note that in spite of overwhelming progress in the science of cosmos, the jury is still out on modern cosmology to furnish satisfactory answers to these queries.

Hidden in the effulgence of the vast Nature are certain all-pervading non-transient rules that Nature has imposed on itself that govern the behaviour of its matter/energy and the functioning of the universe. The physicists through observations, laboratory measurements, mathematical deductions and logic have uncovered these rules and called them the 'laws

of Nature'. Other terms used for Nature's laws are 'physics laws' or 'physical laws'. Associated with these non-transient laws of Nature are invariant physical constants that together define quantitatively the behaviour of matter. They are also termed as Nature's constants or physics constants. Because the Nature's laws and mathematical values of physics constants do not change with time and locale the adjective of 'invariant' is associated with them. For this reason they are also known as the 'universal constants'. If the laws of Nature were transient and the physics constants were variable, the smooth functioning of the universe will be in doubt because the universe and its matter would behave differently at different times and in different parts of the universe. Such a scenario is the recipe for chaos. Observation and logic led the ancient Vedic *rishis* to formulate in the AtharvaVeda mantra (10/8/7) that the entire universe functions under **एकनेमि** (*ek-nemi*), the same law (one principle). Nature chose order over disorder. The presumption that the universe has followed the same laws of Nature since its birth and that it will continue to do so in future, allows a physicist to extrapolate in both directions on the arrow of Time to recreate the universe's past and predict its future as well. This extrapolation in both directions is the science of cosmos. To perform this extrapolation a cosmologist invokes physics laws in a complex mathematical framework and attempts to explain the observed phenomena of Nature. It is the reverse interpolation right to the first moments of the creation that explains how it all began.

The term, 'creation' throughout the book has no religious connotation. It has no relation to the contentious issue between contemporary cosmologists and creationists or to the ongoing debate on creationism, grand design or Darwinism. It is as neutral as in – the creation of water requires one Oxygen atom and two Hydrogen atoms.

The term 'creation' in the Vedas includes the advent of the universe and all substances in it, animate and inanimate. Pertaining to the physics laws and constants, one must grasp the fact that there is extreme criticality in their existence and the values. They are critical in the sense that they are just right and even the minute alteration in them would send the present universe on the course to chaos or create altogether a different universe. Nature, within this criticality in its laws, has allowed us conscious-beings to be born at a given point in its history and among them allowed the intelligent humans to be born to comprehend the knowledge of its existence

and its functioning. Nature allowed us to observe its diversity in the form of various phenomena embedded in it and allowed us to become cognizant of its all-pervasive rule of "cause-and-effect" that leads us to discover the laws that govern it. If a phenomenon like the universe is time-dependent and if Time is seen as a non-reversing entity, one could conclude that what existed before may have a connection to what exists later. This connection is obvious in physical phenomena where pre-existence of something enables the existence of something else. The pre-existent substance therefore is the cause for the subsequently enabled substance. In the specific example of a mother and child, the mother is the cause for the child who is born later in time. When one looks deeper into this law of Time one finds that after all 'what came before what' and 'what caused what' has led to the discovery of all of Nature's laws that we know of and will lead to the discovery of all those laws yet to be discovered. Knowing Nature's laws has in turn enabled us to predict Nature's behaviour.

To be governed by laws is inherent in all aspects of Nature. Like Nature, the living-beings also set some rules and follow them for smooth functioning and predictability in their lives. While no one can tell how much deliberation went on before a rule of Nature matured into its final critical form, the rules set by living-beings have certainly evolved over time and out of intellectual analysis and logic; an example being – 'telling the truth is good for all'. We do not see any sign of evolution in Nature's laws. The laws and rules of humans generally are not perfect and need tweaking every now and then whereas the laws of Nature are perfect and are non-transient and invariant from the beginning. Whereas the thoughts generated in the human mind are responsible for inventing a rule, the thoughts are also responsible for the needed tweaking of the rules. It is the thought generating machine or a force with its exclusive existence in living-beings, decidedly sitting somewhere in the head, that generates all thoughts and is not found in the inert confines of the inert Nature. If our laws need to evolve to reach a level of 'telling the truth is good for all', why is it that Nature's laws are perfect from the very beginning? Did Nature have thoughts to tweak its laws? Answers to such queries have not come forward and are not easy.

How are thoughts created by the thought-producing machine in a living-being's head, has also been an age old query. In modern times differing possibilities are proposed and explanations are furnished for what generates thoughts. It is said that the brain creates thoughts. It is also said

that the brain is only a tool but it is the mind that initiates all thoughts. A lot of research has gone on and still continues to determine what the mind is and how a thought is initiated in it. A lot has been learnt about the subject, however, the present status of this subject is generally summarized in a sentence - it is not yet understood how the mind works. The ancient Vedic thought on this subject takes us a step beyond the mind in that the thought creation is credited to an entity, whose presence enables consciousness in a living-being. All thoughts and actions that follow in a living body are thought to be the effect of this cause, the quantum of consciousness. This quantum of consciousness is not a physical machine made up of atoms and molecules; it is the operator beyond a physical plane that generates thoughts in the mind which delivers them to the brain for further processing and shaping. Whatever the mechanism of thought creation, the ability to initiate action in the physical body resides in the brain. The brain also has the ability and built-in functions to analyze the thoughts that are generated, sets rules based on the thoughts it had generated earlier and also adjusts, changes or drops the pre-established rules later.

We create rules and change them for greater perfection. So, the question remains - when and how did Nature perfect its laws? When we observe Nature and discover its unchanging laws, it makes us wonder if it also had its own mind that was used to evolve its laws over time and came up with a perfect set of laws to create the universe. Or could it be that a seemingly strict follower of all physical laws, the Nature itself was captivated by rules that were extrinsically imposed on it because it had no mind of its own or it had no choice to break them or adjust them? A modern cosmologist's response to these questions is likely based on un-provable hypotheses that he introduces and renders the expected common answers: no one is doing the thinking for inert Nature; this is just the way Nature is; it is by chance that our universe has this perfect set of laws; the other universes have their own sets of laws. One thing is certain. When a modern cosmologist uses a hypothesis for the creation of the universe, his model has no provision to create Nature's laws first. He follows the laws that already existed in Nature.

Just as the observation of Nature by modern scientists led to the discovery and formulation of the laws of Nature, it must have been the observation of Nature and its behaviour that led the ancient sages of the Vedas to express their thoughts in mantra formulations. As is evident from

the formulations found in the Veda mantras, the deductions in Vedic cosmology must have been based on the profound study of Nature.

To express a thought with clarity one needs not just the vocabulary but the right vocabulary. The right vocabulary and its richness reflect the degree of thought investment that was put in to delineate and explain a subject or a phenomenon. A phenomenon in Nature can have more than one property. To express differing properties one needs to generate differing vocabulary. This is what is found in the Vedas. This is what tells us with certainty that a lot of thought investment had taken place to understand and to explain Nature and the process of the creation of the universe itself. The *rishis* of the Vedas gave not just the needed terminology for the subject of cosmology; they created a system to create generously the synonyms to represent differing properties of important entities in the creation.

In the Western philosophy and languages one word, 'nature', derived from *natura* in Latin, which means 'essential qualities or innate disposition', serves to represent all aspects of the Nature-entity that Carl Sagan was referring to. The Vedas use distinctive terms for Nature to represent its specific stages, properties and functions. Whereas the Sanskrit term *prakriti* is the most common synonym for Nature, one finds in the Vedas a large number of synonyms for *Prakriti*. This author has listed in Table 5.1 of Chapter 5 in this book some 39 synonyms of Nature out of many more found in the Veda mantras. Each name is based on the 'root' of the word-formation which reflects the property of the entity. Out of the large number of synonyms found in the Vedas for the important objects of Nature this author has listed 20 for the Sun (Table 11.4 in Chapter 11, Volume 2), 33 for the Earth (in Tables 11.6a, b in Chapter 11), 22 for the Space (Table 5.6 in Chapter 5). This alone suggests that the Vedic Civilization in its distant past had invested quite heavily the mental power to understand Nature and its actions. They also uniquely defined the abstract entities like the Time and the Space. The solid evidence of this is well preserved in mantra formulations in Sanskrit, the language of the Vedas.

The names of the four Vedas are: RigVeda, YajurVeda, SaamVeda and. AtharvaVeda

The science of word formation in Sanskrit is based on *dhatu* (root) system. Therefore the term used for an entity itself delineates its property and ascertains what the term stands for. Several of the Vedic terms for the

Nature-entity in Table 5.1 of Chapter 5 reveal that it is an inert entity, same as in modern cosmology. The examples of the synonyms reflecting this specific property are: *Achetan* (an entity without consciousness), *Agjyaan* (a non-knowledge-entity), and *Andham* (without the ability to see itself and around it to give itself a direction or one that is blind to knowledge). There are several more synonyms indicating the same. The uniqueness of these Vedic synonyms becomes obvious from the meaning of the terms. A detailed discussion on Vedic-defined Nature is in Chapter 5; here it would suffice to say that the Nature for the Vedas is a conglomerate of inert matter causing the physical universe without having the ability and initiative to create its own rules. It is *Andham* and therefore a slave to the physical laws imposed on it extrinsically.

Even though Nature is an inert entity in Vedic as well as in modern cosmology there are differences in how it is perceived in the two cosmologies. The example of an earthen pot-maker is usually cited in the Vedic Philosophy. The inert lump of clay on the fly-wheel does not transform into a pot without the extrinsic intervention of the pot-maker's thought, energy and hands. For modern cosmology, the clay, the pot-maker, the pot-maker's thoughts, energy and hands are all together part of the same thing – the inert Nature. In modern cosmology the laws of Nature and its behaviour are self-generated and self-implemented, without having regard to how, by whom and when all the laws were created in such perfection. In this scenario the advent of the conscious-beings in the universe is just another act of Nature and the appearance of the mind in a living body is just another accident in Nature. A living-being is found to be enslaved by Nature, not having the freedom to increase its mind's capacity to any level it wanted. On the one hand the living-beings, humans in particular, derive from Nature the ability to understand it and even to make educated guesses regarding when and how 'it all came to be' and on the other hand the Nature disallows us from fully understanding it by putting hidden bounds on *what humans can know*, as Sagan put it. The fact remains that while a better understanding of the universe has been developed in the present times, the ancient queries, some of which being the same as in Sagan's quotation, have not been answered fully yet.

Modern cosmologists generally believe that Time and Space are real entities and without them one cannot explain the universe's creation and behaviour. This author has differentiated the 'entity' from its 'measured

value' by using respectively the upper and the lower cases of the first letter of the term. Thus the terms Time and Space represent the Time-entity and the Space-entity and the terms 'time' and 'space' represent their measurements. The same style is followed for the other entities as well.
The fact about Nature is that a physicist could capture a piece of it in some form or the other (matter or energy) and save it in his laboratory for one to see, feel, smell or taste and the fact about Time and Space is that he cannot cut or capture a piece of Time or Space to save it. This raises a natural question – if one is not able to capture the Time and Space entities, do they exist in reality or are they mere illusions of mind? A modern physicist uses them for interpreting Nature's phenomena. It would be of interest to know at what point in the history of civilization a physicist learned that Time and Space are real. One has to admire those who thought about the real existence of the abstract entities, such as Time and Space and established their importance in the formation of the universe. When one explores into the Vedic mantras one finds that the concepts of Time and Space have been as old as the Vedas. If Vedic rishis learned about the reality of Time and Space they must have used these entities to enhance their knowledge, science and philosophy.

## Concept of Nature, Time, Space and Big Bang are Ancient

Modern cosmology's trinity (Nature/matter, Time, Space) is needed to explain how the universe came to be. In his theory of relativity Einstein said that space and time were in a continuum. The mathematical meaning of his 'space-time continuum' is quite deep; however, its simple meaning is that one needs both entities to understand the universe. Although a modern cosmologist has no idea what these abstract entities are made of, it is universally accepted that both, Time and Space, are two separate entities completely different from each other in nature, function and usage. If both are different entities then it is counter intuitive to think that one would affect the other and the two dissimilar entities of abstract nature would form a single 'space-time continuum'. Considering that the modern Big Bang Hypothesis emphasizes that the Time and Space took birth first time at the time zero of the Big Bang the Einstein's 'space-time continuum' in this

author's perspective is more like conjoined-twins with different DNA, born of different mothers, but got attached at birth only by the skin! Since no one has witnessed *where the cosmos came from, or whether it* (universe) *was always here* and what Time and Space actually are, any proposition on this by the most brilliant of brilliant cosmologists at best remains a hypothesis.

There have been some hypotheses suggesting that the universe was always here and will continue till eternity. Presently, the most accepted hypothesis of the universe is the Big Bang Hypothesis. In this hypothesis the trinity of modern cosmology is said to be born for the first time out of dimensionless Nature's womb, the 'space-time singularity' that gives birth to the universe in an explosion called the Big Bang.

The universe being created out of the dimensionless singularity means that the entire matter of the universe was concentrated at one dimensionless point before the Big Bang took place or was concentrated at one point at least during the first moments before it spreads. The Big Bang singularity at time zero is said to be at an extremely high temperature, of the order of $10^{32}$ ºK. The number with 10 raised to 32 is equal to the number with 32 zeros after 1, which in common units is - one hundred million-trillion-trillion degrees Kelvin. The temperature of Sun's centre in comparison is only at $1.6 \times 10^{7}$ ºK (16 million ºK).Such a high temperature is neither observed in Nature nor can it be created in a most advanced modern high temperature physics laboratory.

We observe in Nature that the temperature is a property of matter. Therefore the temperature of space-time singularity is the temperature of the matter in the singularity. That the matter existed in a dimensionless singularity is by itself counter intuitive thought and that the matter of the entire universe, estimated to be $10^{60}$ kg, came out of a volume-less point, is a strange thought by all standards.

One can think of the temperature as equivalent of the energy in a system, however, the nature of temperature is that it does not exist without matter and cannot be sensed in the absence of matter. The Matter is primary and the temperature is secondary. Therefore, the dimensionless space-time singularity before matter is created should logically be cold, leave alone being at trillions of degrees of temperature. The matter in the first moments of the Big Bang appears in the so-called Planck Era when it is said to be at the highest temperature; the Planck Era duration being only $0.539 \times 10^{-43}$ seconds. The minus sign before the exponent 43 means that it

is less than 1 second. The Planck Era therefore lasts only for a period of 0.539 seconds divided by a number with 43 zeros after one. The universe during this period grew from zero to one Planck-length of $1.6x10^{-35}$ meters across. More details on the Big Bang Hypothesis are in Chapter 2 under the title – "The Present Understanding of the Universe: A Critical Scrutiny of Big Bang Hypothesis".

One could ask a physics riddle in three different ways: "in what zero-dimensional entity is hidden away the entire universe?", "what entity was made up of two ingredients which are not in it?", "what entity exists in mathematics but not in physics?" The answer to all three riddles according to the Big Bang Hypothesis is – the 'space-time singularity' which by definition was dimensionless. This in common language – was not there! It is not a real physical condition that can be created in a physics laboratory or observed anywhere in the present universe; however, it can certainly exist in a mathematical construct of a cosmologist. As mentioned before, three entities are simultaneously born in the Big Bang Hypothesis; the Nature-entity (matter/energy), the Time-entity and the Space-entity. Not considered in the Big Bang Hypothesis or not clear from it is the possibility of matter of the universe existing before the Big Bang and whether Time and Space entities also existed before the matter appeared? The other limitations of the Big Bang Hypothesis, discussed in Chapter 2, forbid this hypothesis from acquiring the status of a principle in physics.

To the surprise of most, the Vedas have a definite scenario of their own for the creation of the universe. The Vedic scenario is formally encased in the mantras in specific sections of the chapters, embellished with appropriate titles. Vedas have dealt with the subject of cosmology in considerable detail. The term "Vedic Cosmology" will be used in this book to differentiate the ancient cosmology in the Vedas from the modern Big Bang cosmology. With regard to the creation mechanism and the sequence of the created byproducts the Vedic Cosmology is remarkably different from modern cosmology. On the other hand the modern Big Bang Hypothesis has considerable semblance with Vedic Cosmology as well. Based on a large set of Veda mantras and other Vedic references (RigVeda, 10/129/1-7; 10/72/8-9; Manusmriti, 1/5, 6, 14-16; Shatpath Brahmana, 10/1/3/1; 11/1/6/2; 11/1/1, 2) this author has drawn 28 physics deductions in Chapter 6 that set the stage for developing **the Vedic Big Bang** scenario in the Chapters 7 to 10. The author named the Vedic creation process as

"Vedic Big Bang" because it sets forth the birth of the universe out of an impetuous explosion in the enormous primordial ovate of brilliantly hot matter named हिरण्मयमाण्डं (*hiranmayam-aandam*), the literal meaning of which is – "the golden-embryo" or "the ovate/spheroid with hot golden brilliance". The similarities between the Vedic Big Bang developed in Chapter 6 and the modern Big Bang Hypothesis presented in Chapter 2, both separated by a time-gap ranging in millennia, are mind-boggling. Based on different sets of Veda mantras the Vedic Big Bang Scenario and the Vedic Big Crunch Scenario are developed in Chapters 7 to 10.

The definitions of the major entities taking part in the Vedic creation process (Nature, Time, Space, …) and the analysis of the Sanskrit terms pertaining to the creation process of the universe in Vedic Cosmology and Vedic mechanics, form the body of the Chapter 5.

The universe in Vedic cosmology begins from the indefinable *Asata*-state of Nature (matter) held in shrunken Space; albeit not with zero dimensions as in the Big Bang singularity. The *Asata*-state of matter by definition being completely devoid of energy or dynamic activity, there is no temperature in it. After all, the temperature in matter is due to dynamics in its components. The Matter in such an indefinable state, without energy (dynamics), can therefore come together to confine in a relatively small space. This space occupied by Nature in its dissolved state is termed as '*tuchchhaya*' (RigVeda, 10/129/3). The term '*tuchchhaya*' stems out of the 3rd mantra in the Vedic Cosmology Principle stated in the 129th *sukta* of RigVeda's 10th chapter. It represents the adjective for Nature in the *Asata*-state and RigVeda has exclusively used it for *Prakriti* (Nature). The meaning of the term '*tuchchhaya*' is '*one that is confined in small space*' or '*one that is in diminutive state*'. The ordinary meaning of the term is - 'relatively very small'. It is amazing that the Vedic universe begins with matter in diminutive volume (*tuchchhaya*) and the modern Big Bang begins with a dimensionless 'space-time singularity'. The physics reality necessitates that the indefinable *Asata*- state of matter without energy will confine in diminutive volume (*tuchchhaya*) and not in zero space of 'space-time singularity'. The process of creation of the universe in Vedic Cosmology is the transition of matter from the *Asata*-state to the *Sata*-state the definable matter state suitable for forming substances and objects of Nature.

The term '*tuchchhaya*' being the geometric adjective for the Nature in its inactive state one can by reduction apply it to the Space-entity that holds the inactive Nature. The Space-entity in the Vedic creation scenario therefore does not ever disappear in a space-time singularity. The function of the Vedic Space-entity is to provide home for the matter and energy that forms the universe. Unlike the modern Big Bang cosmology where the existence of the Space-entity begins in the singularity, the state of Space in the Vedic creation changes but its existence continues eternally through the cycle of creation-dissolution. The important outcome of this comparison is the relationship of Nature to its container - the Space. On this, Swami Dayanand Sarasvati (1825-1883 CE) a monk and a great nineteenth century Vedic philosopher and reviver of the Vedas, expressed with clarity of thought in his book "Satyarth Prakash" (publ.1881 CE) that the matter of the universe (Nature) and the Space are two distinct entities and that the Space was the place for the matter to exist. And all this he expressed on the basis of the Vedas as back as the late $18^{th}$ century, well before the hypothetical concept of the all-pervading 'ether' of the Western science and philosophy. Swami Dayanand Sarasvati's statement differentiating between Nature and Space came precisely 35 years before the birth of the 'space-time continuum' in Einstein's Theory of Relativity. The basis for Swami Dayanand's statement is not his own or from a near past, he only stated the Vedic Philosophy established in the far antiquity beyond Mahabharata about 5,000 years ago.

One difference between the two cosmologies is in the initiation process of the creation itself. The initial Nature in the modern Big Bang Hypothesis is dimensionless yet hot and is its own energy to trigger the explosion at the time t = 0 second of the Big Bang. The Vedic Big Bang on the other hand is initiated at the Time $t = t_n$ seconds where time $t_n$ refers to the $n^{th}$ creation riding on the eternally flowing Time-entity. This means that the present creation according to the Vedic Creation Principle is one of the infinite creations in the past and is one of the infinite creations to come in future. The Vedic creation-dissolution of the universe is a perennial cycle of the state of matter transiting from *Sata* to *Asata* and back to *Sata*, with the life-span of each phase according to the Veda is not thousands or millions of years but in billions of years.

The other main difference in the two cosmologies is that the Vedic Big Bang takes a period of one *deva-yuga* of 4.32 million years (MY) to

develop the required heat energy in its primordial हिरण्मयमाण्डं (*hiranmayam-aandam*), the golden-embryo, before it explodes into *koti-koti* smaller *aandams* (ovates of matter); the *koti-koti* being the superlative for 'uncountable'. The details on this scenario are deferred to Chapters 7 to 10.

This author feels that it is the Nature (matter/energy) that is understood better by modern cosmology than Time and Space; both eternal entities in Vedic physics (philosophy). The reason is that the matter of the universe interacts with the knowledge senses directed by the entity called Mind. The Mind in a living-being according to the Vedic creation is a byproduct of matter at extremely minute level. On one hand the entire universe finds itself immersed in the Time and Space entities and on the other hand both entities offer themselves to matter at extremely minute levels. To answer a query like, *if time will one day flow backward*, one has to first know what Time is. Since the modern cosmology received the gift of 'space-time continuum' in 1916 CE from Einstein's Theory of General Relativity, small sectors of the Time-entity with minute pieces of the Space-entity are utilized by modern cosmologists in the field equations to hypothesize the advent of the universe, yet they do not seem to understand what is the nature of these two entities.

Modern physics has discovered that the fundamental nature of Nature is quantized. By quantized is meant that matter at its most fundamental level is an individual quantum, the ultimate unit of matter. These quanta or corpuscles of matter are known as quarks which serve as the smallest building blocks of matter. In addition to quarks there are other stable and unstable matter particles that physicists have detected in their laboratory measurements. The quarks are not found free in Nature because they are all consumed in forming the neutron and proton that form nuclei of atoms. A neutron, the electrically neutral nuclear particle, is formed when one 'up-type' and two 'down-type' quarks come together and a proton with a positive electrical charge is formed when two 'up-type' and one 'down-type' quarks come together. The Hydrogen atom, the smallest atom, is formed by a proton (two 'up-type' and one 'down-type' quarks) and a negatively charged electron orbiting around it. More triplets of quarks in a nucleus form heavier atoms. A quark therefore could be considered as the smallest indivisible particle of matter. A proton having a diameter of $10^{-13}$ cm (one-tenth of one trillionth of a centimeter) occupies an unimaginably small space. Even though the fundamental particles are extremely small

they are separate entities. Thus the quantized nature of matter makes the entire Nature an entity that is discontinuous at its fundamental level. The energy form of matter, as in a ray of light, is also quantized into individual packets of energy called photons.

It is of profound importance to state here that the Vedas eons ago stated that the Nature (matter) at its fundamental state is quantized with its smallest quantum called *aapah*. It further stipulated that all *aapah* are not one kind but they are three distinct types owing to three different properties: *satah, rajah* and *tamah*. When the three properties are emphasized they are addressed as *sato-guna*, *rajo-guna* and *tamo-guna*, where the suffix term *guna* means 'property' (details in Chapter 5). Whereas the general term for the fundamental components of matter is *aapah*, the smallest particle of matter is termed as *paramanu*, the last stage of matter. Therefore a Vedic *paramanu* is either a *sata* particle or a *raja* particle or a *tama* particle. A *paramanu* by definition in Vedic concept is an entity not divisible further. More than one *paramanu* form an *anu* just as more atoms form a molecule. The Sanskrit term *anu* stands for the antonym of 'fat'. This means that an *anu* is not fat yet with extra matter in it. It is implicit in an *anu* that it is a three dimensional substance and a unit by itself. The euphonic combination of *param* + *anu* forming *paramanu* therefore refers to the last stage of *anu*. Because it cannot be divided further a *paramanu* is a *nitya* entity - one that does not change with time. These unchanging smallest units of matter make up the entire *Prakriti* (Nature) and therefore the Nature is also a *nitya* entity.

With regard to the physical shape of a *paramanu*, Rishi Kanaad in Vaisheshik Darshan (7/1/20) has stated the nature and geometry of a *paramanu* stating - *नित्यं परिमण्डलम्* (*nityam parimandalam*). This translates into - "*eternal and spherical*". It is *nityam* because it will remain non-divisible forever is Nature and the sphericity will remain its geometry. The fact is that if a spherical particle is attached to another spherical particle the resulting particle cannot be spherical. Therefore, a non-spherical shape cannot be a particle's last state. It is interesting to note that the Greek word 'atom' also means – 'one that is indivisible'.

All these Vedic definitions are not the invention of this author. They are preserved in the Vedas and the Vedic Darshans (Philosophies) since the antiquity of human civilization; the Vaisheshik Darshan of Rishi Kanaad in particular. Remarkable in the ancient Vedic science is that a trio of matter

particles forms a fundamental unit of functioning matter, something similar to what is in modern physics.

One thing glaringly obvious here is that when the matter's fundamental state is defined in a Vedic scripture, it has little to do with religion, spirituality or worship of a Creator. It is pure science. It may not be commensurate with the contemporary physics, but the Vedic definition of matter is not ordinary. It makes one wonder as to what led the *rishis* of the Vedas to come up with the fundamental division of matter into a triplet that was so close in approach to one in modern physics eons later with three quarks forming a nuclear particle. Details on the Vedic definition of matter and its states are in Chapter 5.

The modern physics/cosmology is not fully clear about the nature of Time and Space. There are numerous questions on these entities that remain unanswered. To come up with a solution to the Big Bang field equations a cosmologist begins his calculations by inputting small slices of time and space equivalent of Planck-time and Planck-length respectively. The cosmologist calls this extrinsic insertion of time and space in the equation as the birth of Time and Space entities. The fact is that in this birthing of the universe out of the dimensionless space-time singularity the new matter of the universe is created according to the laws of Quantum Physics but under what laws are created the time and space?

A cosmologist understands from previous deductions in physics that the Planck-time is the smallest division of time where the meaning of time begins; however, the cosmologist does not really know whether Time is a continuum or a quantized entity and whether this first moment of Time is a single quantum of Time or just a slice of time with many quanta hidden in it. After the Time is presumably born in Big Bang a cosmologist is not sure how it grows; quantum by quantum accumulating to 13.8 BY till now or in a continuum with its beginning in Big Bang.

Physicists are in the same boat with the Space-entity because the Big Bang cosmologists surmise that the Space-entity like the Time-entity is also born at the onset of Big Bang. According to the Big Bang Hypothesis and on the basis of the astronomical observations of the size of the observable universe, it is now estimated that, corresponding to the age of the universe of about 13.8 BY, the Space has stretched from zero to well beyond the observable limit of the universe about $8.8 \times 10^{23}$ km across (0.88 trillion-trillion km) and it still continues to expand. Physicists do not know what the

Space-entity is made of, the entity that suddenly appeared out of nothing at the birth of the universe and thereon continued to stretch in all directions to great distances without snapping. It is not certain yet whether it is a continuum or is composed of small quanta.

The Time and Space entities in the Vedic thought are eternal because an eternal entity according to the Vedic philosophy has no 'cause' for its birth. No 'cause' for the creation of Time or Space is known. The logic behind this Vedic principle is that if an entity is created as an 'effect' of a 'cause' the entity cannot be a continuum and anything that is created has the transience in its nature. Therefore the Time and Space in the Vedic Cosmology are continua. This also means that the transient universe comes into existence and goes into dissolution phases, again and again.

The Time and Space as the primary participants in the creation of the universe are common factors in the Vedas and in modern cosmology; however, there are distinct differences between the two perspectives as well; eternal versus born in Big Bang. The birth of the universe in Vedic Cosmology is only an event in the perennial cycle of creation and dissolution with Time continuously flowing forward and the Space expanding initially during the creation-phase of the universe and shrinking back to smaller confines at the universe's dissolution. At dissolution, the entire matter of Nature returns to its indefinable concentrated state where Space is still needed to hold it and Time is still needed to flow in one direction to bring the next event of creation.

Thus, the Time, Space and Nature in the Vedic Cosmology never return to a condition of 'nothingness' of the space-time singularity of the modern Big Bang Hypothesis. Based on the Veda mantra references, a detailed discussion on the concepts of Time, Space and Nature is presented in Chapter 5 of this book. After defining the fundamental nature of matter (Nature) a brief discussion on the definitions of the Time-entity and the Space-entity is preempted from Chapter 5.

# Time-entity in Vedic Literature

The universe is a mind-boggling phenomenon, even for a cosmologist or an astronomer. It occupies vast space with '*bbbillions-and-bbbillions*' of stars in it, as Sagan used to put it with tremendous emphasis on the letter 'b' in the word billions! Numerous questions on the phenomenon of Time have been raised but all answers may never come owing to human limitations as Sagan had also wondered – '… *whether there are ultimate limits to what humans can know*…' Implied in Sagan's earlier quotation - '…*if time will one day flow backward and effect precede causes*...' is that the 'cause-and-effect' is a time-dependent phenomenon with the 'cause' preceding the 'effect'. Therefore turning an 'effect' back to its 'cause' could happen only when time is an entity and could be reversed too. Even in rewinding a movie and seeing the characters going backwards the time pertaining to all other events and substances has moved forward. The Big Bang Hypothesis is a forward model with time starting at t = 0 sec and moving forward.

As in the Vedas and the Vedic Philosophy this author sees the 'cause-and-effect' as an all-pervading principle in Nature. It is an all-pervading phenomenon because every object of the universe, every event in the universe and the entire universe are immersed in unidirectional Time-entity and bound by it. Simply put - all events in the universe ride on Time while the Time keeps moving forward.

Is 'cause-effect' a recent tenet recognized in human civilization? Certainly not! In the Vedic Cosmology, the cause-effect principle is a pre-ordained character of Nature, the latter being an inert conglomerate of fundamental particles serving as the 'material-cause' of the universe. The cause-effect principle is taught by the Vedas through mantras, directly as well as indirectly. The joint term 'cause-effect' corresponds to the joint term **कारण-कार्य** (*kaaran-kaarya*) in Sanskrit. The cause-effect (**कारण-कार्य**) principle is briefly discussed later under the sub-heading - "The Vedic *Kaaran-Kaarya*: Cause-and Effect-Principle".

One develops the specific feeling of first and next at different levels of awareness. When one ponders over a specific event of the past with eyes closed, one gets the cognizance of 'first and next' in that event. When one uses the eyes and observes a sapling grow one tends to store in memory the feeling of 'first and next' and 'earlier and later'. This feeling is created

because of the existence of Time. The development of the basic feeling of 'first and next' does not require high intellectual potential in a living-being, however, to develop the feeling of 'first and next' while looking for the relationship between the first and next is an intellectual pursuit. When this intellectual pursuit establishes a definite relationship between the first and the next, such that the existence of the next is out of the first, the mind recognizes the preexistence of the principle of cause-effect. The cause-effect is inherent to Nature owing to Time and its recognition and application to Nature's phenomena is the source of knowledge. It strengthens the logic system of the individual through the *differentiation between the knowledge and fallacy*'. Its application has no bounds. It is the application of cause-effect to the creation of the universe that leads to the development of the science of cosmology and when applied to the Nature and our place in it, it leads to the development of philosophy. The degree to which it is applied in a society indicates the degree of intellectual pursuit in that society.

The ancient *rishis* (sages) of the Vedas and the Sutras (Darshan-philosophies) have since time immemorial comprehensively emphasized the logic of cause-effect to understand the concepts of Time, Space and the creation of the universe itself. A society that explored the application of cause-effect in both realms of the universe, animate and inanimate, is no ordinary society. Admittedly the hearsay of the excellence of a society does not make it an extraordinary society either. The evidence of a society's high intellectual level is reflected in the wisdom contained in the literature of the society. Mantras after mantras in the Vedas, *sutras* after *sutras* in the Darshans (Vedic Philosophies) and *shlokas* after *shlokas* in Smritis, Upanishads and Brahmana books contain rich discourse on science and philosophy that includes the phenomena of Time, Space, Nature, Consciousness and other concepts difficult to grasp. The Vedic sages explored in depth these phenomena primarily because these phenomena have been the primary participants in the process of creation.

The Vedas emphasized that the Time, Space, Nature (matter) and Consciousness are different from each other, are not consumed by matter, are not consumed by each other and they do not consume matter. The matter is utilized by consciousness that emerges as the living bodies of living-beings, but it is not consumed; the matter of the universe remains conserved. The Time-entity for the Vedas and the Vedic *rishis* remains

unaffected by the presence of matter in it, the Time-entity flows forward in one direction and the Space-entity expands from its *tuchchhaya* (diminutive, RigVeda, 10/129/3) volume before creation to its capacious volume like a natural un-packing of a flower from a microscopic bud to a full-bloom.

As mentioned earlier the most common Vedic synonym for Nature is *Prakriti* and the common synonyms for Space-entity are *Antariksh* and *Aakaash*. The Vedic term for the Time-entity is *Kaalah* or simply the *Kaal*.

AtharvaVeda, the fourth Veda, invokes the virtues of the *Kaal*-entity presenting 15 mantras in two *suktas* (hymns). Several of these are discussed in Chapter 5. A glimpse of how the *Kaal* was viewed by the ancient Vedic *rishis* is exemplified here by referring to just three part mantras from the AtharvaVeda. The literary decoration with parable and simile is obvious from these mantras:

*"Kaal the son is its own father* (the past) *and will be born as its own son* (the future)...". (AtharvaVeda, 19/54/3).

*"Kaal is like the potent un-ageing horse in perpetual motion (flow) on which ride the* ***sapt-rashmi*** (seven-colour-rays of the Sun) *and the* ***sahashra-aaksha*** (*thousand-eyed*) *Sun*…." (AtharvaVeda, 19/53/1).

*"In this creation none is older than Kaal…"* (AtharvaVeda, 19/53/4).

These part mantras alone convey several physics aspects of the Time-entity. The first mantra, a marvel in metaphor, states the three sectors of the Time-entity. The first and the last mantra reveal the eternal nature of the Time-entity.

Everything in this creation is transient and aging. It is therefore a highlight of poetic expression when the Veda in the second mantra compares Time with an un-aging, unstoppable (powerful) horse that moves-on perpetually. The riders on this horse are the observable time-dependent natural phenomena such as the "thousand-eyed Sun" (***sahashra-aaksha*** a poetic hyperbole) that sees all around itself and the sunlight with its beauty in seven colours **(*sapt-rashmi*)**. The seven colours in the solar spectrum and the Sun being all-illume all around is today's scientific reality stated in the Veda thousands of years ago. We see the brilliant Sun and the beauty created by its light in a rain-bow but the Veda recognizing the solar rays and

the Sun as time-dependent phenomena is remarkable in itself. Anything with dynamic nature, which includes everything in the universe, is time-bound. As we know it now that the solar rays take about 8 minutes to reach the Earth, indicating that they are not a phenomenon of action-at-a-distance.

For Carl Sagan's query, "*If time will one day flow backward…*", to come true the solar rays must become static first and all cyclic orders in Nature should cease. We do not observe any sign of time-reversal in our vicinity or in the astronomers' observation of the far reaches of the universe. We do not even know what it would look like or feel like if Time started to reverse. We may as well reconcile with the fact that *Kaal* (Time) the "*potent un-ageing horse in perpetual motion* (flow)" will keep moving forward.

Some time ago when asked by a host on Canadian Broadcasting Corporation, '*what is Time*', the visiting guest, Professor Roger Penrose, the eminent British mathematician/cosmologist answered – "*…to understand Time we have to understand what Mind is and what consciousness is…*". The fact is that the Big Bang field equations have no parameters or variables to deal with the phenomenon of Mind or Consciousness. Therefore, the modern cosmology with all its complexity in modeling the universe would not be able to shed light on what consciousness is! This is why this author remarked earlier that the modern cosmologists use Time and Space entities in their model but they do not understand what they actually are!

The Vedic philosophical perspective on consciousness is a discourse to be rendered in another book; however, a brief commentary on the phenomenon is contextually included at places in this book. It may be mentioned here that this author has questioned the basic logic of the evolutionary biologist, Dawkins, who defines consciousness in terms of a "*useful model*" of a conscious-being.

When modern cosmologists refer to 'time reversal' and the 'effect preceding the cause', the context is the Time undoing sequentially what it has done this far in the creation of the universe. Logic requires that for it to reverse the Time must have a beginning. In the Vedic thought the Time is *anaadi* (eternal), as implicit also in the AtharvaVeda mantra (19/53/4) cited above. The Nature (matter) in Vedic thought is also eternal but its matter transits from *Asata*-state of dissolution to the *Sata*-state of creation. The reversal from creation to dissolution and vice-versa takes place without

reversing Time. Because all matter of the Nature in the Vedic creation-dissolution cycle is conserved and only its state changes, like in a reversible chemical reaction, the universe reverting from creation to dissolution is not time reversal. The discourse on cause-effect is enriched with simple deductions in Darshan (philosophy) *sutras* based on the Veda mantras, such as '*the effect is always different from its cause*', '*the effect is coarser than the cause*' and several such.

A detailed discussion on the tremendous progress in time measurement by modern physics is beyond the scope of this book. However, on how deep the Vedic scholars have gone in measuring and resolving the Time entity is presented in detail in Chapter 5 and briefly in what follows. The definition of Time from the perspective of practical application of Time is furnished in the ancient book on practical astronomy entitled 'Surya Siddhant'. The book of Surya Siddhant, better known in Western astronomy as 'The Sun Principle', is a treatise on the indigenous practical astronomy developed by the ancient Aryans of India. It is in the form of *shloka* composition; a *shloka* in Sanskrit is a metered poetic couplet expressing a specific thought. There are numerous *shlokas* in Surya Siddhant on Time and its division as well. The first *shloka* on the basic nature of the Time-entity is the $10^{th}$ *shloka* in the first chapter of Surya Siddhant. Its English translation is as follows:

"*Time is in two classes. First, the cause for creation and dissolution* (being eternal) *is unknowable and the Second is knowable. The Second-class is in two categories – one is moort* (comprehensible and measurable) *and the other is sookshma* (immeasurably minute)." (Surya Siddhant, 1/10).

Implicit in the first part of the *shloka* is that the Time-entity itself being eternal remains an unimaginable entity, because only the created objects and phenomena in the universe have the property of transience, form, function and expanse. It is the form, function and expanse of objects that enable their measurement and at least enable the imagination of their existence and enormity. In the Vedic thought, both kinds of physical phenomena, *moort* and *sookshma*, are deemed as real. The term *moort* means - one having the form and size, enabling its detection, observation or measurement and therefore it is the subject of the knowledge-senses (unaided or aided). The term *sookshma* on the other hand means - one that is subtle, beyond the senses and only the subject of cognitive faculties. An example of *sookshma* time in modern physics is a Planck-time, $10^{-43}$

seconds ($10^{th}$ of a million-trillion-trillion-trillionth of one second) which is not a subject of the senses and cannot even be measured directly in a laboratory. Thus the Time-entity has been recognized in the Vedas as a real entity accessible in the realm of measurability and inaccessible in its realm of immeasurability wherein it is eternal and extremely minute.

Modern physics deals with the, *moort* and *sookshma* classes of time, former in practical applications and the latter in theoretical applications. It is shown in Chapter 5 that the Aryan time measurement units are derivatives of science application and quite elaborate as mentioned above covering a range from 4.32 BY down to the practical unit of *nimesh* (1 *nimesh* = 0.177778 sec = 8/45 sec) in 18 divisions of the time scale. In some ancient astronomy texts, for example in the $16^{th}$ and $17^{th}$ *shlokas* of 'Siddhant Shiromani', written by Bhaskaracharya in the $12^{th}$ century CE, there are two more finer divisions of the time unit of *nimesh*. The $30^{th}$ part of a *nimesh* is 1 *tatpar* which is 6 milliseconds and $30{,}000^{th}$ of *nimesh* is defined as a *truti*, where the term *truti* stands for the minute division of time representing "uncertainty" or the "accuracy" in time measurement (see also Surya Siddhant commentary by Mahaveer Prasad Shreevastava, 1987CE). A *truti* in Vedic astronomy therefore is about 6 micro-seconds (six one-millionth of a second). The physics of the derivation of the practical time unit named *nimesh* is also discussed in Chapter 5. Several paragraphs devoted to this practical time unit show that it could not have been arrived at without accurate experimentation in physics and human physiology and all that was accomplished by a Vedic *rishi* in the far antiquity of the Vedic civilization.

## Space - entity in Vedic Literature

The Vedic concept of the Space-entity based on Vedic mantra references is also discussed in detail in Chapter 5 under the sub-title of "*Aakaash-tatva*: The Space-entity". The Space-entity of modern science is the *Aakaash*-element of the Vedas. This invisible entity is a real entity in the Vedas as also in the modern cosmology. An example of how the Space is viewed in the Vedic discipline is exemplified from Swami Dayanand Sarasvati's statement in his book "Satyarth Prakash" (1881 CE). What he

stated in Hindi language is translated in English by this author, as following:

*"…Reality is that the Aakaash* (Space-entity) *is not a created entity* (it is eternal), *because otherwise without its pre-existence where could the Prakriti* (Nature) *with its paramanus* (atoms) *stay....?"*

Swami Dayanand Sarasvati's above statement is based on the Veda mantras. It is obvious from this statement that the *Aakaash* (Space-entity) in Vedic Philosophy is eternal and must pre-exist the formation of the atoms of Nature and its function is to provide a place for their existence. It is also obvious that the preexistent *Aakaash*, responsible for holding the matter of the universe, which is *Prakriti*, is a different entity altogether from *Prakriti* and that *Prakriti* at its fundamental level is made up of corpuscular *paramanus* (fundamental particles).

The practical Vedic units for space measurement are tabulated in Chapter 5 with emphasis on the unit of *yojan* (1 *yojan* = 13 km). The distance unit of *yojan* in differing applications appears in several Veda mantras, either independently or in association with the time unit. The RigVeda mantra (1/123/8) relates the unit of *yojan* to the motion of the light swath of the morning-twilight sweeping the Earth as the Earth turns; the morning-twilight being a dynamic physics phenomenon in atmospheric optics. The mantra states:

*The morning Twilight (Usha) with its immutable occurrence is born daily in the vast home of Varun (atmospheric water-air-ocean system) and moves swiftly demonstrating its qualities in* एकैका **(***akaika*), *in concatenation*, *up to 30* ***yojan***". RigVeda (1/123/8).

Among several physics observations in this mantra it specifically states that the morning twilight, the diffused sunlight (indirect sunlight) successively keeps illuminating the dark-side of the west of the sunrise point with a light swath extending up to a distance of 390 km (30 *yojan*). Because the Earth rotates around its axis the dynamic spread of twilight moves westward of the sunrise point, nonstop. A *rishi* must have carried out optics measurements to determine this number. Additionally, to estimate this distance the *rishi* had to know the circumference of the Earth and the speed of spin of the Earth. Knowing these parameters in the far antiquity of the Vedic civilization is remarkable in itself.

Now we know that a point on Earth's circumference moves with the speed of 464 meters/second, which is faster than the speed of sound. Therefore, the twilight swath successively illuminating and moving forward at this rate not only implies that the Earth is round but the *rishi* also knew what its circumference is. A complete discussion on why 390 km twilight swath in the Veda corresponds to the calculated tropospheric height of 11.95 km is in Chapter 5 under the sub-heading – "The Case of Vedic *Usha*: the Morning Twilight", delineated with a ray-tracing diagram. The twilight is the diffused sunlight scattered from the tropospheric layer. From the 26 RigVeda mantras on *Usha-devata* (Twilight) several virtues of the morning twilight are listed that glaringly exhibit physics thought. To conclude, the rate of spread of Twilight west ward on the surface of the Earth could not have been arrived at without a rigorous experiment in time, space and atmospheric optics. And all that happened in the far antiquity of the Vedic Civilization!

The other example that boggles one's mind is the ancient Vedic calculation by some *rishi* for the speed of light represented in terms of *yojan* and the time unit of *nimesh*. It is also amazing that, the speed of light determined by this *rishi*, discussed in Chapter 5, is extremely accurate from present standards of unit measurements.

As mentioned before that this author has collected 22 of many synonyms for the Space-entity. This means 22 differentiating properties of the Space-entity. This author could safely surmise that if asked a contemporary cosmologist to list all properties of the Space-entity he would have difficulty exceeding 22.

The Vedic cosmology presents with dexterity the characteristics of the Space-entity that have not been imagined as yet in modern times. *Pushkaram* is a Vedic synonym for the Space (*Aakaash*). Rishi Yask's ancient book Nirukt (5/3/2/2) provides the etymology for the term *pushkaram*. It relates to Nighantu 48$^{th}$ (special collection of Vedic terms). *Pushkaram* is derived from a single *dhatu* (root) but is a multi-meaning term. Three out of five meanings of *pushkaram* are furnished here:

- *Space is **pushkaram** because it does poshan (provides care) of all substances of the universe, animate and inanimate, by benignly providing space for their existence.*

- *Space is **pushkaram** because it rises above matter, like a lotus flower rising out of mud, yet remaining beautiful and unblemished.*
- *Space is **pushkaram** because it has the property of pushpate, one that swells like a flower.*

These statements have physics implications: that the Space is essential for the existence of matter and therefore for the existence of the universe itself; the Space is an entity separate from the matter of the universe (lotus and mud); the matter does not react with Space or change Space's constitution (does not *blemish* it) and the Space expands (*pushpate*) as the universe expands (expanding universe an eons old Vedic thought, mantra references in Chapter 9). The remarkable physics properties of Space in these statements and a dozen additional different properties of the Space-entity in differing contexts are discussed under the sub-heading "The Space-entity (*Aakaash-tatva*)" in Chapter 5 entitled "The Primary Vedic Entities in the Creation of the Universe". The discussion is supported by about 15 references from Nirukt (2/3/1), Bhagvadgita (13/32), Shatpath Brahmana (11/1/6/22), Vaisheshik Sutra (2/1/20), and the Vedas. Several of these properties of Space have not been explicitly identified or explored by modern cosmology.

The Veda has addressed the Space-entity with the adjectives such as the "Flower of the Creation". The Space after creation does what a flower does when it is created by a plant. This simile could be understood by most. A bud before efflorescence begins at a single point, folded with efficacious mastery to occupy very compact space with all the petals in an irreproducible and irreversible packaging. This compact space of the bud contains the ingredients of its own little universe, waiting to burst open with a bang. When the bud blooms into a flower, it is like an event of a little big bang, displaying its ingredients while drawing unseen energy from its plant and rendering a variety of unique shapes of its components. The bloom spreads from a *tuchchhaya* (diminutive) space into a relatively larger space revealing a full-fledged creation of its own.

This phenomenon starts with a microscopic three-dimensional bud in the shape of an ellipsoid or an ovate which announces the advent of a flower in the diversified form and splendor of nature with colours and fragrance.

*Pushkaram* property of Space. The two blue dots on the opposite sides of the tip of the compact bud (light green) correspond to the two blue dots far apart on the opposite petals of the opened flower. The expanded flower (pink) and the bud are in proportionate size.

When we observe its advent and observe its previously hidden components and ingredients, we take it upon ourselves to define it by creating appropriate nomenclature such as sepals, petals, filaments, pollen and so on in the likeness of stars, super-novae, quasars, solar systems, galaxies, black-holes and a host of differing formations in the vast universe. Thus, it becomes obvious as to why the Space acquired the adjective of a flower in the Vedas. In terms of the cause-and-effect, each Vedic word for each object, an action or a phenomenon in Nature, is the effect, the cause of which is the root of the word with specific properties.

The *rishis* in the Vedas and in the post-Vedic literature explained complex subjects with simple examples, parables and similes. Invoking the simile of a flower for the Space-entity is most appropriate and clever. This author draws parallels between the blooming of a flower and the spreading of the cosmos in Space. The author followed a bud till it bloomed fully into a flower. A tiny green bud and the pink flower are shown in the picture. Two ink dots on the opposite side of the bud correspond to the two ink dots on the opposite petals of the flower. The bud and the flower in the picture

are in actual relative size and on blooming, the flower occupied 40-50 times the space of the bud, in just a few days. The separating of the dots relative to each other as the flower bloomed reveals the way the galaxies separate from each other increasing the space between them. A Vedic *rishi would* not draw a simile between the *Aakaash* (Space) and a *pushp* (flower) and call Space a *pushkaram* without knowing that *Aakaash* expands like a flower. The question remains - how did the *rishis* know that *Aakaash* expands? Amazing!

Another Vedic term *vapushkar* for *Aakaash* (Space) means '*Aakaash keeps its form even when in use by a substance of any form*'. The implication of *vapushkar* property of Space, pertaining to space-time continuum and warping of Space near massive celestial bodies and bending of light rays is discussed with new explanation in Chapter 9.

The swelling of the Space-entity after the advent of the universe, carrying the matter of the universe with it, relates to the "expanding universe". The author presents numerous mantras stating that the universe is expanding. As an example the RigVeda mantra (10/56/5) states with clarity that the *Antariksh* (Space-entity) was spreading and along with it spread out the cosmos; which in modern cosmology is the same as the expansion of the universe.

Considering that Rishi Brihaduktho Vaamdevya formulated the mantra stating that the universe is expanding, one could surmise that the *rishi* must have been an assiduous astronomer observing the constellations night after night and observed the cosmos separating from each other. The fact is that he must have found, like a contemporary astronomer with most powerful telescope, that the galaxies and stars in our observation range do not show apparent daily or yearly separation as a part of the expansion of the universe. This is because the expansion in the locally observed constellations is not discernible. Yet the *rishi* said that the Space was expanding. So what was the meaning of all this? Let us discuss this a bit further.

We are not talking here about the planets of the solar system changing their position night after night – we are talking about the stars and the galaxies outside our solar system. Observing the stars of the night-sky at their respective positions, night after night, would not lead anyone to detect the property of expansion in the universe. If it weren't for the Doppler red-shift effect in the spectrum of the faraway galaxies, modern astronomy

could not conclude that the universe was expanding. It was the red-shift in the spectrum of faraway galaxies reaching the telescope and not the actual motion of the galaxy that led Edward Hubble in 1929 to conclude that the galaxies were flying away at high speeds. But the fact also is that Rishi Brihaduktho Vaamdevya concluded in this RigVeda mantra that the invisible entity *Antariksh* (Space) was spreading and that the cosmos were spreading with it. Therefore, the mantra and the Vedic thought in it are remarkably intriguing. Rishi Vaamdevya must have a basis for labeling the universe as "expanding". The *rishi* must have had a sound theory or carried out experiments in astronomy, not necessarily measuring the red-shift. No matter how one interprets this mantra (and several more); the Vedic principle contained in it is no different from one of the most important findings of modern astronomy that the universe is expanding. It is intriguing!

After detecting the red-shift caused by the Doppler Effect between moving objects (observer and the galaxy), the Big Bang equations were corrected, making the expanding universe as the basic feature of the Big Bang Hypothesis. A word-for-word translation of this mantra is presented under the sub-heading "Expanding Universe a Vedic Discovery Eons Ago", in Chapter 9 on Vedic Big Bang scenario. A brief discussion on the red-shift is included in Chapter 2 and its cause in the faraway galaxies, from a Vedic perspective, is presented in Chapter 9.

The concept of Space in the Vedic civilization is as old as the RigVeda itself. The Veda mantras have been the basis for the interpretations and elaborations in the post-Veda literature on Vedic philosophy. A section of the post-Veda literature is called the Brahmanas or the Brahmana Books. Yet another section of the literature is in *sutra* formulations called the Vedic Darshans (philosophies). Rishi Kanaad, a post-Veda philosopher in the far antiquity of the Vedic civilization expounded the subject of Space in great depth in his Vaisheshik Sutra. Again, the details on this are in Chapter 5, however, a brief philosophical perspective on Rishi Kanaad is presented here.

Rishi Kanaad states the *lingam* (defining-sign) of the Space-entity (*Aakaash*) in the Vaisheshik Sutra (2/1/20):

*"The property permitting the 'exit from and entry into' is the defining sign of Aakaash"* (Vaisheshik, 2/1/20).

Implicit in this simple formulation, *exit from and entry into*, is that the Space is unaffected by objects moving in and out of it. It is an astute deduction by Rishi Kanaad for an abstract invisible entity. This defining-sign (*lingam*) of the Space is delineated in the example of a ball (in Chapter 5) thrown by a pitcher where the ball on its trajectory successively enters the *Aakaash* (space) at one point and exits to enter at the next point without distorting the space left behind. Vaisheshik by Rishi Kanaad is one of the oldest Darshans that precedes the Mahabharata War which according to the Indian calendars, when converted to the Western calendar, ended in 3140 BCE (proven by this author in Chapter 3).

Krishna, well after Rishi Kanaad and just before the onset of the Mahabharata War preached the philosophy of life to Prince Arjuna of Hastinapur (near Delhi). Krishna's sermon to Arjuna at the battle-field of Kurukshetra (near Delhi) is well-known as the book of Bhagvadgita with 18 chapters in it, which in fact is a part of the book of Mahabharata. Bhagvadgita has fascinated some of the recent scientists, including Albert Einstein, Albert Schweizer and J. Robert Oppenheimer, just to name a few.

A *shloka* couplet from Bhagvadgita's 13$^{th}$ chapter also relates to Rishi Kanaad's basic definition of the Space-entity and goes beyond it, drawing a parallel between the Space (*Aakaash*) and another entity that is also not bound by matter. The translation of the Bhagvadgita's *shloka* reads thus:

> "*Just as the all-pervading Aakaash (Space), owing to its minute nature, does not attach to any object in it, the soul-entity in the living being also does not attach to the matter of the physical body*." Bhagvadgita (13/32).

The main clause in this Bhagvadgita *shloka* pertains to the soul-entity, wherein Krishna emphasizes the soul's most important property of non-attachment to matter. Implicit in Krishna's expression is that the soul-entity and the physical body (matter) are two separate entities and the soul and the Space are two different entities. The most important observation in the *shloka* is the parallel that he draws between a specific property of the soul-entity and that of the *Aakaash* (Space-entity), the latter being a subject in cosmology. The Space owing to its minute nature does not attach to any object embedded in it. The primary difference between the two according to the Vedic philosophy is that the soul is a single quantum of consciousness

and therefore localized at a given point in time and space, whereas the inert Space-entity is conterminous through the universe. The common property between the soul-entity and the Space-entity is the property of non-attachment. In other words, the soul-entity is neither bound by the matter nor is it consumed by matter. This raises a natural question - if the soul does not attach to the living body how can it function in it?

The answer to this question lies in the example of a driver in a car. The driver is a conscious-being and the car is an inert entity. The driver desires to hold the steering-wheel, to start the ignition, to put the car in gear and to press the gas-pedal with his foot. This transforms the inert machine into an apparent animate object. The driver's hands and foot remain detached respectively from the steering-wheel and the gas-pedal. The driver after driving stops the car, stops the engine and steps out of the car. The car turns into an inanimate object. Krishna's explanation of non-attachment of the soul to the body is in the likeness of the driver's non-attachment to the car. It is this property of non-attachment, common to the soul and the Space that Krishna explained with clarity to Prince Arjuna. Modern cosmology gives no consideration to the imperceptible phenomenon of consciousness and therefore to the concept of the soul, however, it cannot do without the imperceptible Space-entity. One could still pose a non-philosophical question. Since no one has seen a soul and no one has seen the Space then how could Krishna know what a soul is and what the Space-entity is? Obviously there are no physics answers to these questions. Even a physicist who believes in the existence of Space-entity will not be able to give exact answer to - what is the Space-entity?

Rishi Kanaad's 'defining-sign' of the Space-entity and Krishna's complementary elaboration of its property of minuteness, its non-attachment with matter and non-consumption by matter, are remarkably brilliant deductions. The phrase in modern cosmology - 'the space is curved', did not escape the careful consideration of the *rishis*, although it may have slightly a different meaning in the ancient Vedic cosmology. The Space-entity for this property is adorned by the adjective, *teeryak*. The literal meaning of the term *teeryak* is – '*one that has directionality like the path of an arrow*', which is always curved. Simply put, the Vedic 'Space is curved' but it is not curved by the gravity of a massive celestial body. The discussion on this aspect of the Space being quite involved, it is taken up in Chapter 5 under the sub-heading of '*Antariksh*: the Vedic Space is Curved',

where several mantra references are invoked (AtharvaVeda, 10/2/24; 10/2/25; ….).

Not just the Space-entity (*Aakaash*) as a "general-cause" or the Nature-entity (*Prakriti*) as the "material-cause" of the universe but other entities and processes partaking in the formation of the universe are also uniquely defined and described in the Vedas.

# Rotating and Expanding Universe – an Ancient Vedic Thought

The force of gravity due to mass in matter pulls the universe inward. To have the universe expanding, a force opposite to the force of gravity was to be conceived. Not having such a force in existence the cosmologists had to imagine that a background energy field, ubiquitous through the universe, must exist to explain the continued outward expansion of the universe. Not knowing what this energy could be, it was named as Dark Energy. From there on the Big Bang Hypothesis shifted from the trinity formed by Nature, Time and Space to a quadrate with the fourth corner formed by the Dark Energy. Because the universe is said to be presently expanding at an accelerated rate, the effect of the Dark Energy exceeds the effect of gravity. This necessitated Einstein's original field equations for a static universe to change to include the expansion of the universe.

Not having a confirmed mechanism for the production of the Dark Energy and not having a convincing common physics logic to support its existence a rhetoric question was put forward - if not the Dark Energy what else is expanding the universe? Hypothesizing the Dark Energy aside, it is not clear whether the Dark Energy pre-existed the Big Bang or it is a byproduct of the Big Bang. If it appeared with the Big Bang what mechanism created it? If it is a quantized entity like other known radiational energy forms, what kind of quanta would constitute it? If it is a continuum, is it discontinuous beyond the last galaxy at the edge of the universe? The answers to these questions have to come from the Big Bang cosmology without invoking new hypotheses. Are all other potential possibilities exhausted to explain the observed expansion of the universe? The Big Bang Hypothesis has answered many questions related to the observations of the phenomena in the observable universe and as discussed in Chapter 2, it has also raised many questions.

The question - if not the Dark Energy what else is expanding the universe – is answered uniquely in the Vedic Big Bang Scenario developed in Chapters 8, 9. Startling to the contemporary cosmologist it may be, but the eons old fact in the Vedic Cosmology, preserved in the form of mantra formulations, is that the universe is expanding. (RigVeda, 10/56/5; RigVeda,

10/72/8; RigVeda, 10/129/5; ….). The explanation for the expansion of the universe, as identified by this author, comes from other mantras (RigVeda, 7/63/2; RigVeda, 10/89/2; …) where, in addition to the translational (linear) expansion of the universe, the major expansion is due to the rotation of the universe as a whole. That the entire universe is rotating around an axis termed as *Skambha* is a unique physics thought in the Vedic Cosmology. It is the centrifugal force of rotation that creates the tendency of throwing the matter of the universe outward causing the expansion of the universe. The ancient Vedic thought that the universe is expanding because it is rotating has led to several new deductions in new cosmology, discussed in Chapter 9.

The moving objects generally are in two types of motion: linear and angular. In a linear motion the object moves from one point to the next along a straight line whereas in angular motion the object moves on a curved path. All celestial bodies are on angular motion around their own foci - the Moon around the Earth, the Earth (and other planets) around the Sun and the Sun (and other stars) around the centre of our galaxy, the Milky Way Galaxy. Our galaxy may be rotating around its own focal point. According to the Vedic thought the Milky Way Galaxy and all other galaxies of the universe are rotating around a common axis named the *Skambha*. The Veda states with clarity that the rotational motion is not only a feature of the celestial objects that rotate around their own respective local centers of rotation, but they all together are also in rotation around the centre of the universe. This feature of the Vedic Cosmology is quite different from anything in the modern Big Bang cosmology.

The relevant Vedic mantra references, implicitly and explicitly state that the rotational momentum (mass x rotational velocity) in the objects of the universe is an endowment of the inherent rotation in the primordial Nature (RigVeda, 7/63/2; …). In the Vedic scenario of the creation of the universe, both, the translational (linear) and rotational (angular) momenta within the primordial Nature are imparted to the matter of the universe at the time of the Vedic Big Bang. It is the rotational energy, not thought of in the modern Big Bang Hypothesis, that could be adding its own effect to the observed red-shift in the faraway galaxies.

In the Vedic scenario, with gravitation to contract the universe and the centrifugal force of rotation to expand it, one does not need a hypothetical

Dark Energy. The observed red-shift in the spectrum of the fast receding galaxies, in the presence of this universal rotation, could partly be an artifact created by the translational and rotational components of the rotating universe. This effect in red-shift is further discussed in Chapter 9.

According to such a Vedic scenario, the source of rotational momentum in all galaxies, solar systems and in all celestial bodies is primarily due to the original rotational momentum in the primordial blob of Nature, whose original shape is defined by its Vedic names, *Maart-aand* (Mortal-ovate) being one. The Sanskrit meanings of the terms used in Vedic Cosmology, depicting the primordial universe's shape, nature and action are discussed in detail in Chapters 7 to 9. It is also discussed there that the Vedic scenario for the formation of galaxies in an ever expanding universe makes a better sense as well. The galaxy formation is the result of matter accumulation under gravitation in a given region of space. In a linear expansion of the universe, as in the Big Bang Hypothesis, one should really be surprised that even a single galaxy was formed when matter was only separating away vigorously.

The galaxy formation mechanism in the modern Big Bang Hypothesis is based on the hypothesis that the galaxies are the result of the original irregularities in the matter distribution of the primordial universe, that were formed right in its first moments during Planck-time of $0.539 \times 10^{-43}$ second. The mathematical manipulation aside, it is not intuitive and not very convincing that in the modern Big Bang scenario with tremendous explosion at one point with super high radial speeds in matter, the matter density nodes that existed in the unimaginably short time period and in the negligibly small space would not fall apart with time as they flew away with tremendous force.

The Vedic Principle formulated in Chapter 6 and a large number of additional mantra references, lead to the development of the Vedic Cosmology Scenario developed in Chapter 7 to 10. Discussions on rotation and expansion of the universe, logic for galaxy formation and the age of the universe are a part of this scenario. The Vedic age of the universe is not as high as the age estimate in modern astronomy; however, a remarkable feature of the Vedic age estimate of the universe also runs in billion years.

## The Theistic Argument

In modern Big Bang cosmology the two opposite forces, gravitation and Dark Energy, pervading through each other affect matter of the universe, one contracting it and the other expanding it, but without one affecting the other. In addition to the force of Dark Energy, there are four fundamental forces in Nature discussed under the sub-heading, "Fundamental Forces of Nature" in Chapter 2. All forces have the inherent nature to pervade through each other without destroying each other. What mechanism created these four forces and what mechanism created the non-destructive property in each force is another mystery of Nature. Then, who is to vouch that in addition to the force of Dark Energy and all the other known physical forces, yet another all-pervading force-field could not or did not pervade through the universe with consciousness its additional virtue? A failure to detect a force using instruments made of matter does not prove its absence.

The Vedas being theistic, the mantras at times give credit to another kind of all-pervading force with consciousness its additional virtue. Present cosmology is carried out with half a dozen physical forces including the force of Dark Energy, each playing their own specific roles. Then a consciousness force could also coexist to play its own role. In the Vedic concept of creation of the universe, the entire universe with all its matter, energy and different physical forces is embedded in an all-pervading Consciousness Field. It is this force that is considered to be governing the behaviour of the universe in both its realms - matter and consciousness. It is the Consciousness Force that is the source of all the laws in animate and inanimate realms. Most mantras with science thought in them are without a reference to the Consciousness Force, however, when a mantra with science thought in it gives credit to the Consciousness Force; one could set aside the Consciousness Force without losing the benefit of the science thought in the mantra. Therefore, the theism in the Vedas does not negate knowledge extraction from the mantras and does not affect developing the scenario for the creation of the universe.

The Consciousness Field is Veda's 'efficient cause' of the universe with the matter (Nature) being its 'material cause' and the Time and Space being its 'general causes'. Based on the discussion thus far, especially on the Vedic definitions of Time and Space, it is evident that there was considerable thought investment by the Vedic *rishis* in the realm of cosmology and the entities that form the set of the 'material-cause', the

'general-cause' and the 'efficient-cause'. Veda mantras delineate with clarity that the thought investment has led to knowledge development in the areas of physics, astronomy, cosmology, philosophy and even spirituality; the last two still remain outside the framework of pure sciences. The *rishis* also developed enriched knowledge base in the area of the relationship between consciousness and matter. They gave consideration to the metaphysical energy fields created in the first moments of the universe that lead to the development of functions in conscious-beings, the functions such as the Intellect, Ego and Mind. These entities, the product of Nature, are the subject of another book. A brief comment on Mind is as following.

In trying to understand the Mind-entity the contemporary scientists find that it is a very complex phenomenon in living beings. Mind according to Vedic Philosophy is a quantum of energy that operates inside and outside of the living being. Owing to its minuteness it cannot be detected or captured. Anything not measurable by physical means is generally said to be metaphysical or super-natural and is generally labeled as 'may exist in reality or may not'. In the Vedic concept, the Mind-entity arises in the living unit of matter owing to the presence of the consciousness corpuscle present in that living unit. The Mind is an entity in the realm of matter and is a companion of the soul; the latter is an eternal non-matter quantum of consciousness. Both coexist in the preferred locale of the physical body that has a limited transitory life-span: metaphorically prescribed to be 100 years for humans. The soul-entity is said to be a perpetual traveler of the universe, stopping at rest-areas (living bodies), gathering knowledge about the world with the help of companion instruments, the Mind being its most active instrument.

## Recognition and Dissemination of New Thoughts

Complexity exists all around us. The complexity is in the nature of Nature. Living-beings, a byproduct of Nature, are riddled with complexity in their nature and in their physical construct. It is in their nature to try and unravel the complexity that surrounds them. When a human-being uncovers a secret of Nature it is not kept a secret. It is disseminated for the benefit of others. Others examine it, evaluate its truthfulness, reject it or accept it. Recognition of the process of thought generation and dissemination has been ongoing since the existence of living-beings and more so in the

humans in developed societies and civilizations. When the truth is reached and recognized as such by a society, it becomes a precursor for discovering more hidden truth.

What is 'truth' and how do we know if it has been reached? The Vedic definition of truth is contained in the Sanskrit alphabets that form the Sanskrit term for 'truth'. This term is **सत्य** (*satya*). The word '*satya*' (सत्य) is derived from the *uss dhatu* (root) and *krit pratyaya*, leading to its meaning – '*that which is'*. The word analysis of the term *satya* (सत्य) itself points out that it is a conjugation of two words *sa* and *iti* (स + इति) which together mean "*that's it, period*" or '*that only*' or "*nothing else in it*". Truth has no structure or fine-structure and is without alternatives. It does not associate with probabilities and exclusion principles. Often times it looks as though the truth was reached until a new thought comes along, necessitating reconsideration and reiteration. The **सत्य** (*satya*) or the truth by Vedic definition is an invariant in time and space.

At times when the complexity of the creation of the universe in both realms, the animate and the inanimate and the complexity of many phenomena embedded in it are well understood by some brilliant and well-known scientists, it may seem that the final truth was reached. At times the enthusiastic scientists present their discovery as the 'final truth' and declare that they have reached **सत्य** (*satya*). The human limitation at times causes confusion between *satya* and what seems like *satya*. An example of this is the 'final' declaration by one of the most brilliant cosmologists of our time, Stephen Hawking. Two parts of this 'final' declaration are in the following that he stated while discussing his new book entitled "The Grand Design" co-authored with Leonard Mlodinow.

(A) *"The scientific account is complete. Theology is unnecessary…"*

(B) *"God is not necessary and that the universe is deterministic with free-will in living-beings only an illusion"*.

Let us examine these statements and determine how close both statements are to the 'truth', the **सत्य** (*satya*). (The author's discussion pertaining to Stephen Hawking was written before his passing). A discovery by a scientist and its experimental confirmation by him/her as well as by other scientists certainly deserves to be elevated to the category of 'a final declaration'. However, the fact remains that the *scientific account* of the

universe, as claimed in (A), is not complete yet, because if it were complete, all the Big Bang cosmologists would be out of work! The fact that they are gainfully employed strengthens the logic that the thought process on the creation of the universe has not come to finality yet and the *scientific account* has not been completely put through a final scientific test yet, where a 'hypothesis' should morph into a 'principle'. The Big Bang Hypothesis, on which Stephen Hawking based his declarations, is still thronged with a large number of hypotheses, some of which do not even make commonsense in physics.

Let us for a moment put aside *theology*, *God*, *free-will in living-beings* and put them all in the category of *illusion* as Hawking suggested in (B) and look at the remainder of Hawking's above statement (A) where he declares – "*The scientific account is complete*". To check the validity of this statement one need not resort to a theological argument because that may not yield the desired results; instead let us invoke the assertions from some high caliber cosmologists and their latest research.

Julian Barbour, a British physicist, has authored and coauthored several books and carried out theoretical research in quantum gravity. Numerous other physicists have published papers based on his theories. Barbour and the physicist Bruno Bertotti developed a technique called "best matching" for deriving gravitational equations directly from astronomical measurements, which without the use of the 'space-time continuum' described gravitational effects as accurately as Einstein's general relativity. The "best matching" also explains that the not well-understood Dark Energy in the Big Bang Hypothesis, responsible for the accelerated expansion of the universe, was unnecessary. Based on Veda mantra references, this author will discuss in Chapter 9 that the universe is expanding and that the mechanism for this expansion is not based on the hypothetical Dark Energy but it is due to the centrifugal energy naturally stored in the rotating universe itself.

Based on his book entitled "Does Time Exist?" a preamble to Professor Barbour's public lecture on June 6, 2012 at the Perimeter Institute for Theoretical Physics in Waterloo, Ontario, Canada, stated:

"*Many attempts to create a unified theory of the universe using relativity and quantum mechanics suggest that time as we seem to experience it does not exist- it may be only a well-founded illusion. The idea of timeless universe can be traced to Plato and his insistence that only*

*being is real, while becoming is an illusion. In this talk Prof. Barbour will explore how the Wheeler-DeWitt equation of quantum gravity suggests the fundamentally timeless nature of the quantum universe. He will also raise unresolved mysteries of our conscious experiences, and why these might provide insight into how a fundamentally timeless universe may be perceived as intensely temporal*".

Hawking's conclusion that "*The scientific account is complete*" is based on the Big Bang cosmology, which is based on Quantum Mechanics to create matter, the role of which lasts only for one Planck time of $0.539 \times 10^{-43}$ second, a period of 0.539 seconds divided by a number with 43 zeros after one. After that the newly born universe is taken care of by Einstein's relativity. The Big Bang cosmology in turn cannot exist without the space-time continuum and without the mysterious expanding force, the Dark Energy, but the Dark Energy is not needed in Barbour's approach. A slice of time as small as $0.539 \times 10^{-43}$ sec creating all matter of the universe $10^{60}$ kg at one dimensionless point in space means that the matter is produced at the rate of $10^{60}$ kg/$10^{-43}$ sec = $10^{103}$ kg/sec. This could happen in a mathematical equation but is beyond the reality of what one observes in Nature. This is exceedingly beyond commonsense and one would think that the Big Bang Hypothesis is pseudo-science. Hawking has to have Time and Barbour says that it is an illusion. Therefore without suggesting who is right, a comparison between the two approaches leads one to think that Hawking's declaration is premature. Let us analyze further the logic in Hawking's two statements (A) and (B).

Hawking's conclusion, '*theology is unnecessary*' has not been scientifically proven yet. Any conclusion without a scientific proof is in the category of a 'belief'. Therefore the conclusion by a modern cosmologist claiming to have reached the **सत्य** (*satya* = truth) that '*theology is unnecessary*' is a belief similar to the belief of a theologian who concludes without proof that 'God is necessary' for the creation of the universe. The Vedic term **सत्य** (*satya*), which stands for 'that only', applies as much to a theologian as to a cosmologist.

Stephen Hawking's statement (B) *"God is not necessary…"* also falls in the same category as his first statement. As argued before, a unique all-pervading force with consciousness as its additional virtue could exist in the universe and go undetected by physical means. Because the non-

detectability of a phenomenon is not the proof of non-existence of the phenomenon, Hawking's statement (B) is not on a sound logic. Considering the discussion in the previous pages one cannot claim that the modern cosmology (Big Bang Hypothesis) has reached the *satya* (truth). The fact is that truth in Big Bang Hypothesis is sought based on several un-provable hypotheses and the fact is that the same basis is being used for disproving the least understood phenomena such as the possible fifth force that theists address as God. The reality is that many consider the phenomena such as consciousness, Mind and spirituality as least understood but real. Thus, the **सत्य** (*satya*) has not been reached yet. However, whatever the level of proximity of the emphatic statements to the truth, one useful outcome of this is that it moves the discussion on cosmology forward and contributes to the story of cosmology. One could say that all ideas are good if they are the stepping stones towards the discovery of *satya*.

While presenting the historical review on cosmology in the first chapter of his earlier book entitled "A Brief History of Time" Stephen Hawking followed the tradition for scholarly publications; acknowledging and referring to the work of other scholars. He started with the Greek philosopher Aristotle (384 - 322 BCE) who suggested that the Earth was a stationary round sphere rather than a flat plate and all other celestial bodies including the stars moved around it in circular orbits. Aristotle also theorized that everything was made out of four elements - earth, air, fire and water. Hawking then referred to the famous Greek astronomer Claudius Ptolemy (87 - 150 CE) who elaborated Aristotle's idea by putting forward a cosmological model of the universe wherein the Earth was still the centre of the universe around which the universe rotated. His ideas dominated till about 1500 CE.

Hawking takes the reader forward with brief stops at well-known milestones on the onetime thorny path of astronomy and cosmology. Big names like Nicolas Copernicus (1473 - 1534 CE), Johannes Kepler (1571 - 1630 CE) and Galileo Galilei (1564 - 1642 CE) are referred to who observed and asserted that the Earth and the other planets revolved around the Sun. Then other milestones came a bit faster which revolutionized the subjects of physical sciences, cosmology in particular. Sir Isaac Newton's (1643 - 1727 CE) remarkable discoveries of gravitation and laws of motion changed the scene of science. Even these were found to be only

approximate when Albert Einstein (1879 - 1955 CE) put forward his theory of relativity.

In addition to the references of the individual personalities of yester years in science and philosophy, Hawking in his story of cosmology also invoked the Jewish/Christian/Muslim religions for their theories of the creation of the universe. However, the much older Vedic religion having had coherent philosophical principles and the "*most sophisticated ancient cosmological ideas"* as Carl Sagan had put it did not get any mention in Hawking's book. The reasons for the absence of Vedic references in Hawking's book could have been that he was not aware of the Vedic religious tradition; that the language barrier did not permit him direct scrutiny of the Vedas; that he went along with the impression created by the available English translations of the Vedas by Western authors and Sanskritists that the so called 'books of knowledge' had no knowledge in them. Mediocrity in understanding the Sanskrit language, particularly the Vedic Sanskrit and grammar, by Indologists and Sanskritists, has certainly been responsible for creating confusion about the Vedas. Whatever may be the cause for the absence of recognition or even a mention of the ancient Vedic effort in developing the knowledge on cosmology, the effect certainly is that the Vedic astronomy and cosmology do not get the rightful place in the modern story of the universe.

One gathers an impression from Hawking's story of cosmology that the sophistication in astronomy and cosmology began from Aristotle in the fourth century BCE leading to the present realistic understanding of astronomy and cosmology. Is it really the case that a better and more coherent understanding of astronomy and cosmology did not exist before Aristotle? To prove that astronomy at a level superior to the earth-centric astronomy of Aristotle did exist before Aristotle, one has to show some authentic references dating prior to the fourth century BCE, indicating that the universe was not earth-centric. It would exhibit an even higher degree of sophistication in astronomy if such references indicated that the Earth was a dynamic celestial body in orbit around the Sun. The fact is that this is exactly what is preserved in the mantra formulations of the Vedas written eons before Aristotle. Therefore there is a need in the modern society for revisiting the story of cosmology and readjusting the historical milestones.

This author's effort in this book is to present the Vedic version of the story of cosmology from the onset of the creation of the universe leading to the formation of the cosmos, with specific attention to the solar system – the planets, the Moon and the *mother* Earth. All parts of the Vedic story of cosmology are based on Veda mantra references. Chronologically these Vedic references are from eons and eons before Ptolemy in the second century CE and before Aristotle in the fourth century BCE. The astronomical deductions from the mantras, that the Earth is a sphere, that it is a dynamic system and is in an orbit around the Sun, are presented in detail under the sub-heading of "*Prithvi:* the planet Earth" in Chapter 11 in Volume 2 entitled "Functioning Vedic Universe". A short discussion on it is advanced here.

## The Vedic Earth - a Sphere, in Motion, Not the Center of the Universe

It would be acceptable to Western Indologists, Sanskritists and historians that the Vedas preceded the Greek thinkers cited above. Even Max Muller (1823 - 1900), who is responsible for publishing the erroneous chronology of the Vedic history, said that the Vedas were assembled in their final form by at least 1,500 years BCE. Hindus have always believed that their Vedas are extremely ancient and no date can be assigned to them and now it is accepted by most Vedic scholars that the Vedas were written in the far antiquity of the Vedic Civilization before any book of Sanskrit Literature got written. Whereas an exact period of the advent of the Vedas is not available, most scholars of Sanskrit accept that they were written before the Mahabharata War. Based on astronomy and literature there is now ample proof, discussed in detail in Chapter 3 entitled "Historicity of Vedic References : The References on Cosmology Precede 5,000 Years" that the Mahabharata War ended around 3140 BCE with the coronation of the Emperor Yudhishthir of Hastinapur (near Delhi). With his coronation began a working calendar named Yudhishthir-samvat (calendar) within the long-running Aryan calendar called Srishti-samvat. The Yudhishthir-calendar remained in use well after the Vikram-calendar introduced in 57 BCE by the Emperor Vikramaditya of Avantika (now Ujjain).

Written records commencing from the 5th century BCE have been independently kept and are still preserved in the four Shankaracharya monasteries, geographically separated by over a thousand kilometers from each other. They were first established by Shankaracharya himself between 499 BCE and 485 BCE. These records are reproduced and discussed by Acharya Udayaveer Shastri in his book "Vedanta Darshan Ka Itihas" (History of Vedanta Darshan) published in 1991 ACE. The beauty of these records is that the events at the monasteries were recorded independently following different ancient calendars - Yudhishthir-calendar, Srishti–calendar (Natural-calendar of the Aryans), Vikram-calendar and Shalivahan-calendar. At some monasteries more than one of these calendars were simultaneously used which established a relationship between the onsets of these calendars. The last two calendars commencing in a well-known and well-established period in India's history are presently in use in the Indian society. The written records at the monasteries validate the onset of these calendars. Based on the hard data available from the old hand-written manuscripts, discussed in Chapter 3, it is concluded that the Mahabharata War, its time period, the onset of Yudhishthir-calendar in 3140 BCE, the account of the war (barring recent insertions) in the book of Mahabharata are a historical reality.

Hastinapur (now Delhi) continues to be India's main capital since before the coronation of Emperor Yudhishthir in 3140 BCE and the onset of the Ydhishthir-calendar. From Yudhishthir onwards, the rule of indigenous Aryan kings continued at Hastinapur, without a break, for 4,332 years till the Muslim invasion of India in 1192 CE. In addition to the social and historical significance of the new-year celebration in two of the most recent calendars, they are in close synch with the Natural-calendar of the Aryans called the Srishti-calendar, all beginning with the winter-solstice. The onset of the Srishti-calendar's *Kali-Yuga*-epoch was on February 18, 3102 BCE which is based on the astronomy of the solar system. Details on the Srishti-calendar and its epochs are provided in Chapter 5. The date February 18, 3102 BCE serves as a time 'milestone' in the Vedic history. Except for the books on Hindu mythology named Puranas, eighteen in number, the Vedas and post Veda books in Sanskrit Literature were written in an unknown period anterior to this 'milestone'. Thus, all Vedic references in this book including those pertaining to the planet Earth, are very ancient and anterior by eons to Aristotle's time.

The Vedic references being the marvels of thought-sophistication, rich in science and philosophy, they ought to find a place in the modern science arena, regardless of how old they are. They cannot be viewed merely as a part of some ancient religion. The sophistication in thought content and its expression in sophisticated Sanskrit vocabulary should caution one not to lump Vedic Cosmology with the Earth-centric astronomy of Aristotle and Ptolemy. The reader will note from the cited Veda mantras that in spite of a big time gap between the Vedas and the developments in modern science, the content in these Vedic references could contribute toward building a suitable partnership with the modern astronomy and cosmology. A full section in Chapter 11 is devoted to the planet Earth where the Vedic terminology emanating out of the mantra references leaves no doubt in the mind of a reader that the Vedas have as scientific a view of the Earth as modern science. Based on the Vedic references a detailed discussion on the phenomena of the created and functioning universe is presented in Chapter 11 which includes the process of the formation of the solar system, the meaningful nomenclature of planets and some details of their characteristics with emphasis on the Sun, the Earth, the Moon, the Venus and the Jupiter. A brief account on the planet Earth is included here.

There is considerable discussion on the planet Earth in Vedic mantra formulations and discussions in the vast Vedic Literature. These references cover the origin of the Earth, its early state, its geology and its shape. It is remarkable to note that the Veda mantras refer to several of its properties: *gurutva* (gravitation), sphericity, the state of its interior, three types of its motions and so on. According to its specific properties the Vedas have addressed the Earth with a large number of meaningful Sanskrit terms. Compilation of Earth's synonyms is found in millennia old Nighantu, the ancient topical dictionary of specific Vedic terms included in the book of Nirukt authored by Rishi Yask. The importance of the book of Nirukt was emphasized earlier in the present text for etymological interpretation of Vedic terms and mantra translation. Cross-referencing by the scholarly in Sanskrit Literature places the book of Nirukt in a historical period anterior to 1900 BCE. Rishi Yask's interpretation of the Vedic terms and mantras related to the planet Earth is quite ancient and unaffected by later Hindu punditry resorting to giving *rudhi* (colloquial/non-*yaugik*) meanings of the Vedic terms. The book of Nirukt certainly belongs to a historical period at least 1500 years prior to Aristotle and Ptolemy from whom the

sophistication in Western modern astronomy began. Nirukt's interpretive commentary on the Vedic terminology and interpretive translation of Veda mantras and Nighantu's word assemblage of the Vedic terms takes us beyond 1900 BCE and the inundation of the book of Mahabharata with Veda mantra references takes us towards the Vedas, well before the milestone at February 18, 3102 BCE.

In the context of his interpretation of specific Veda mantras on the topic of the Earth and the Vedic terms used for the Earth, Rishi Yask in the first section of the second chapter of Nirukt (2/2/1) has listed 21 property-based synonyms for the Earth. In addition to Rishi Yask's list of 21 synonyms, this author has collected about a dozen more from the Vedas and the Vedic Literature. The richness of the Vedic terminology, with a total of 32 synonyms for the Earth, is exhibited in Tables 11.6a and 11.6b in Chapter 11 in Volume 2. Nowhere else, not even in the current state of science development in the society, does one find such rich, defining terminology for one object, the Earth.

The Earth, throughout the Vedic literature, starting from the oldest book of RigVeda down to the five thousand year old references in Sanskrit, is undoubtedly a round spherical body. A RigVeda mantra (10/58/3) states that the Earth slopes down in all four directions. The mantra's relevant first line and translation are as follows:

यत्ते भूमिम्$_1$ चतुर्भृष्टिं$_2$ मनो जगाम् दूरकम्।

(RigVeda, 10/58/3)

**Transliteration**: "*Yatte bhoomim[1] chaturbhrishtim[2] mano jagaam doorkam*".

**Mantra Translation:**

"O man! Your *munn (mind) travels far on the Earth*1 that *slopes down in all four directions*2" (RigVeda, 10/58/3).

The first superscripted term is भूमिम्$_1$ (*bhoomim*) which means 'the Earth'. The second superscripted term चतुर्भृष्टिं$_2$ (*chaturbhrishtim*) is the conjugation of two terms, *chatur* and *bhrishtim*. The term *chatur* means 'four' and *bhrishtim* means 'falling' or 'dropping down'. The composite meaning of the three terms भूमिम्$_1$ चतुर्भृष्टिं$_2$ (*bhoomim chaturbhrishtim*) is – '*the Earth that drops down in four directions*' or simply put '*the Earth that slopes in all directions*'.

The mantra stipulates with remarkable clarity that the Earth is not a flat plate; instead it slopes down in all directions. With this deduction in a Veda mantra, it should not take much for a scholarly *rishi* to conclude that the Earth is round. If any object slopes down in all directions, the object has to be a sphere. Need one emphasize more?

As in the above RigVeda mantra the terms *Bhoo* or *Bhoomi* for the planet Earth are the most common in the Vedic Literature. The name rendering its geometry is formed with the noun and an adjective as "*Bhoo-gol"*. The noun prefix *bhoo* means 'the Earth' and the adjective *gol* means 'spherical'. If translated in the syntax of Sanskrit, the term *"Bhoo-gol"* means "Earth-spherical". In English expression with the adjective preceding the noun, it is "Spherical-Earth".

The various adjectives assigned to describe the Earth in the ancient Vedas, followed by the Vedic Literature including the 18 mythological Puranas written two to three millennia ago, all state that the Earth is a spherical entity. In addition to mythological interpretation of the Vedic Literature, the Puranas also include Aryan history and philosophy. The Earth throughout the Sanskrit Literature has been addressed as *andaa-kaara* (spheroid or ovate) and *chhatraa-kaara* (umbrella-shaped or curved like an umbrella). The Earth therefore, in the Vedas and the subsequent Vedic Literature, was never a "flat plate".

In addition to the above mentioned adjectives associated with the shape of the Earth, the Earth is also called as *koorm-prastha-nibhaa* which in the order of words translates into, *turtle-back-like*. Similarly, the Earth is also called a *koorm-prashtha*. Once again the meaning is - 'shaped like the back of a turtle' or 'like the turtle-shell'. These adjectives convey two most important properties of the Earth: that its shell was hard like a tortoise-shell and that it sloped down in all directions like the back of a tortoise. These similes and adjectives are a unique product of the Vedic science thought. It provides a first glimpse into the physical observation of the shape of the Earth.

There are a large number of mantras in the four Vedas that relate to the Earth, however, the AtharvaVeda, the fourth Veda, has mantras and *sukta* (section or hymn) devoted specifically to describing the properties of the planet Earth. These mantras will be invoked in Chapter 11 with complete analysis of all terms. However, a mantra from RigVeda (the first Veda) is presented in the following.

"*This Earth in space repeatedly goes around* (आ अक्रमीत्[1]) *in a stable orbit, around its progenitor* (पितरम्[2]) *the Sun, holding its water forward"*. (RigVeda, 10/189/1).

Of the two important terms, आ अक्रमीत्[1] (*aa akrameet*) means '*repeated motion*' and पितरम्[2] (*pitram*) means '*the father or the progenitor* or *the protector*'- all meanings apply.

The compact character of the Veda mantra reveals in just a few words several scientific observations about the Sun-Earth system, including that the Earth is born out of the Sun, that it is not stationary, that it repeats its orbit around the Sun, that it does not leave its water behind, that it is in space and so on. In this author's perspective, these are un-ignorable Vedic scientific facts about the Earth. It is obvious that the age-old Vedic science is in league with the relatively new-born (five century old) modern science. Needless to say that the superiority and sophistication one finds in Vedic science is remarkable and exceeds the earth-centric astronomy of Aristotle and Ptolemy.

From the Vedic mantra references on Earth and the brief discussion presented above, it becomes clear that the Vedic view of the Earth is straightforward, that the Earth is spherical and secondary to the Sun in the way a progeny is secondary to a progenitor. Implicit in the Vedic statement is that the Sun, apparently a small disc of fire traversing the sky, is primary and the Earth, with an apparent vast horizon around the observer, with large trees and mountains included, is secondary. This observation is also remarkable and mind-boggling. The angle subtended at an observer's eye by the apparent diameter of the Sun's disc is only about half a degree (32.7' minutes of an arc) which at times is seen even smaller than the apparent diameter of the Moon (34.1'), yet the Veda did not say that the Earth was born out of the Moon or that the Sun was born out of the Earth. The Earth in the Vedas is addressed as a feminine entity. The Vedic view of a father-daughter relationship between the Sun and the Earth is obvious. A large section in Chapter 11, entitled, "*Prithvi*: the planet Earth", is devoted to the Vedic perspective of the Earth.

# Earth's Gravitation - a Vedic Concept

Mantras about the Earth's gravitation are discussed in Chapter 11 under the sub-heading **"**Earth's Gravitation: Veda and Vaisheshik Darshan". As an example a *sutra* (aphorism) from Rishi Kanaad's Vaisheshik Darshan, states –

अपां संयोगाभावे गुरुत्वात् पतनम् (*Apaam sanyog abhaave gurutvaat patnam*.), which means –

"*The rain drops in the absence of the union* (*with air*) *fall down due to* ***gurutva*** (gravitation)".

The fact is that the term *gurutva* in the *sutra* is a Sanskrit term for gravitation and nothing else. The underlying fact of the *sutra*-aphorism is that the knowledge of gravitation (***gurutva***) is far more ancient than 1666 AD when Sir Isaac Newton may have seen the apple fall from a tree. Rishi Kanaad's period being well beyond the book of Mahabharata at 3140 BCE the knowledge of gravity existed millennia before even Aristotle. Newton of course gave gravitation a mathematical expression known as Newton's law of gravitation discussed briefly in Chapter 2.

It may be mentioned here that Rishi Kanaad's statement on gravity is neither fortuitous nor a fleeting one, because to explain the intended phenomenon of gravitation at a deeper level of inquiry, he devoted several *sutras* to the subject. To exhibit the effect of gravity under differing conditions he took up two other examples from daily life. (A) A *moosal* (pestle) free-falling in the *okhal* (mortar) under gravity (Vaisheshik, 5/1/7), when released by hand. He also explains that the upward motion of the pestle is owing to a different force imparted by the hand. (B) An arrow in-flight, with a different force imparted to it by the string of the bow, falling gradually under gravity (Vaisheshik 5/1/16, 17, 18). He explains the forward motion of the arrow invoking incremental initial steps as in calculus.

He also associated gravity to Earth's अदृष्टकारितम् (*adrishtkaaritam,* Vaisheshik 5/2/1, 5/2/2) the invisible action (karma) of the Earth; an erudite deduction indeed! In the same context he formulated the *sutras* for several other functions in mechanics that relate to gravity and to the potential

energy converting into kinetic energy (motion) – *nodan-vishesha* and *udsan vishesha* of Vaisheshik Sutra (5/1/9, 10; 5/2/1).

In the RigVeda mantra (10/189/1) cited above, the Sun was addressed as the पितरम् (*pitaram* = progenitor) of the Earth around which the Earth orbits in आ अक्रमीत्[1] (*aa akrameet*), the '*repeated motion*'. Let us now include here a fascinating example with science thought showing how the Vedic *rishis* have viewed the पितरम् of the Earth. This example is from one of the earliest interpretive commentary books on RigVeda, entitled "Etareya Brahmana" authored by the ancient *rishi* Etareya.

# The Sun Never Sets

The oldest books after the Vedas are several specific commentary books on the Vedas, known as the Brahmana books written eons before Rishi Yask and the great Grammarian Paanini. These books include interpretation, elaboration and instructions for the applications of principles in Veda mantras for improving the life of the individual and the society. There is one primary Brahmana book on each Veda. Additionally there are a few more under the Brahmana title. The common English term *brahmin* for an individual with scholarly pursuit or for one born into Brahmin-caste has no relation to a Brahmana book. Since Veda mantras abound in science thought the Brahmana commentaries are replete with science thoughts as well. All Brahmana books belong to a period that is in the distant past of the Mahabharata period (3140 BCE). Brahmana books have valuable material on cosmology. The oldest among the Brahmanas is said to be the Etareya Brahmana of the RigVeda, authored by Rishi Etareya. The word *etareya* conveys that he was born to the mother named Itara. An extraordinary reference to a scientific deduction about the Sun appears in Etareya Brahmana. This reference states:

"*When the Sun sets in one region of the Earth it creates day in another region of the Earth and that the Sun actually never sets"*.

In the enlightened society of today, one could say that this statement about the Sun by Rishi Etareya is no big deal because with TV and internet information everyone knows that the sunset in one region of the Earth is sunrise in another region. But one has to appreciate the fact that the deduction by Rishi Etareya was drawn in the far antiquity of a society commonly labeled as 'primitive'. What Rishi Etareya stated is the observation in astronomy and physics and therefore this author labeled it as 'a scientific deduction'.

The context of this reference in the Etareya Brahmana is a specific worship ceremony that a worshiper performs with mantra recitation. This

specific ceremony should begin and end between the sunrise and sunset. Rishi Etareya advises in Etareya Brahmana (iii, 4, 6, 44) on how to perform this worship ceremony. The relevant part of it is summarized thus:

*"The worshiper should begin worship with the day and end with the day just like the Sun begins the day at sunrise and ends its day at sunset. The voice being the instrument* (for mantra recitation) *the worshiper should do recitation in strong sound and maintain it through the completion of worship or even enhance the sound in the voice towards its third* (last) *phase, if possible."*

*"In the third phase, owing to the doubt that the Sun might set before the completion of the ceremony, the worshiper need not rush through the mantra recitation and service because –*

स वा एषनकदाचनास्तनेति नोदेति॥ इति ।

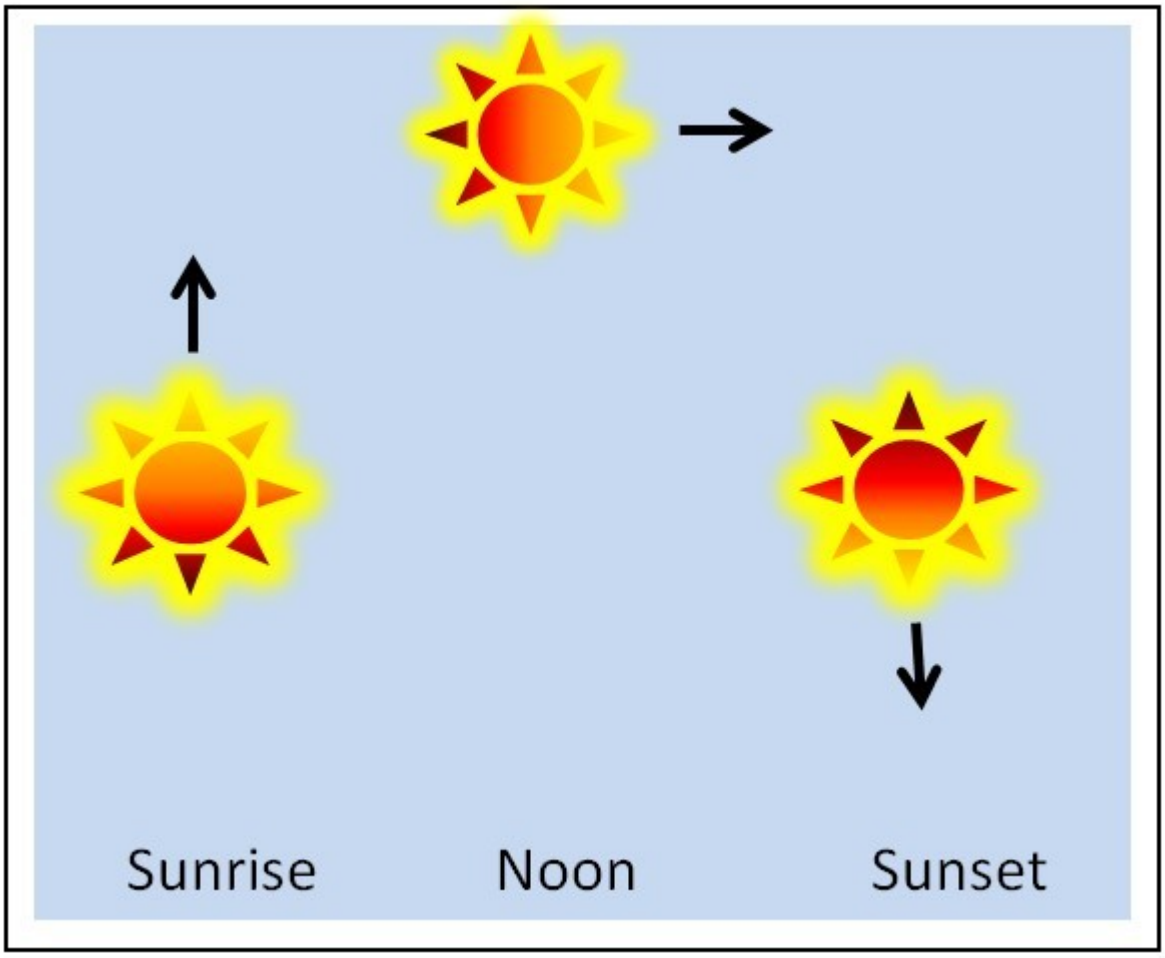
(*sa vaa esh na kadaachanaastneti nodeti. iti.*)*"*.

The last part of Rishi Etareya's instruction to the worshiper presented in Sanskrit, as it is in the book of Etareya Brahmana translates thus:

"*It* (the Sun) *neither ever sets nor it ever rises*"

This alone is a profound observation in science. Rishi Etareya did not stop there. He elaborated upon the meaning of the above statement using four more separated statements. What he said after this is a lesson in ancient physics (only translation provided here):

"*When humans consider it set, the Sun ends the day in their region and it is said to have* विपर्यस्त (*viparyast =inverted*). *Thus, in the past region* (of Earth) *it creates night and in the future region of Earth it creates day*."




"*And when humans say –'it rises in the morning', in reality it ends the night in their region, is* विपर्यस्त (*viparyast = inverted*) *and begins the night in the region which is to come in future*."

"*This Sun never ever sets*".

"*In conclusion, it never sets* (नहवै कदाचन = *na ha vai kadaachan*). *One who understands this knowledge, acquires coexistence with the Sun* (achieves brightness, enlightenment), *acquires its brilliance* (in intellect) *and is born* (in next birth) on planets with brilliance".

The term विपर्यस्त (*viparyast*) in the above two statements stands for 'it sets inverted', thus representing Sun's appearance to an observer at the time of sunset with respect to its appearance at sunrise. In the context of the Sun

being inverted, Rishi Etareya is talking about the Sun's disc, the upper edge of which at sunrise becomes the lower edge at sunset. He further emphasizes that the upper edge at sunset inverts at sunrise. Rishi Etareya's statement is depicted in the diagram by this author with three positions of the Sun; at sunrise, noon and sunset.

Aside from his concluding remarks, Rishi Etareya's emphasis that the Sun never sets is as good today as it was when he wrote the Etareya Brahmana such a long time ago. He clearly means that the Sun is always there in space illuminating one region of the Earth or the other and that the sunrise and sunset are the human definitions of the beginning of the day and the beginning of the night respectively. This also implies that it is the same Sun that is seen inverting its disc when it is in the west at sunset to when it is in the east next day at sunrise.

Rishi Etareya through this simple lesson in physics wanted to tell the worshiper not to get bogged down in blind belief that the prescribed ceremony should end abruptly at sunset, because, as he said with emphasis that '*the Sun never ever sets*'. At the end of his discourse when Rishi Etareya states that the person achieving brilliance in this life is "*born on brilliant planets* (in next birth)", he made two points: that the rebirth system is part of the Vedic Philosophy and thatthere are planets in the universe that are brilliantly lit for life to exist on – what are today's exo-planets.

This was from a voluminous Brahmana book written by a *rishi* in the far antiquity of Indian civilization. It has 285 sections with a large number of statements in each section distributed in 40 chapters. It is now available in modern fine print. This author's copy of the Etareya Brahmana has more than 1400 pages. Based on mantra references from the Vedas and Brahmana books, this author has presented many more scientific details on the Sun, under the sub-heading of "*Soorya*: the Sun" in Chapter 11 entitled "Functioning Vedic Universe".

In contrast with this sample of ancient Vedic science, anterior to Mahabharata, one has the foundation of Western science and philosophy established in the 5$^{th}$ century BCE Greece when a pre-Socratic Greek philosopher, Heraclitus of Ephesus (535 - 475 BCE) believed that the Sun 'took birth every day' and was a giant bowl orbiting the Earth wherein the sea water turned into fire at sunrise. At the Sun set, the fire in the bowl turned into water again and was returned to the sea. At night the empty bowl travelled under the Earth and was ready for another orbit around the

Earth. Therefore according to Heraclitus, the Sun was renewed every day. Not in the Vedic thought!

# Aristotle's Philosophy versus Vedic Philosophy

In Aristotle's philosophy everything in the universe was made up of four elements: Earth, Air, Fire and Water. The Vedic elemental philosophy has five elements; the additional element being the Space (*Aakaash*). In spite of the difference in the two elemental philosophies the meaning and function of elements in Vedic philosophy are altogether different from Aristotle's elemental philosophy. Vedic Philosophy emphasizes that the *panch-maha-bhootas* (five-great-elements) are essential for the sustenance of life on Earth and they relate to the five knowledge-senses in conscious-beings. This is dealt with in another book. It suffices here to say that the Indian Philosophy was well ingrained in the Indian society well before Mahabharata (3140 BCE) and there was a fair bit of exchange of philosophy and mathematics between India and Greece around the time when Alexander the Great invaded India in 326 BCE, a period contemporaneous to Aristotle (384 - 322 BCE). Aristotle probably did not know that the fifth element *Aakaash* (Space) was also essential for the existence of substances.

Hawking in his earlier book has narrated an interesting story of an elderly lady with her Earth-Tortoise theory. This and many such stories have their origin in ancient cultures and civilizations. Such a story may have had full meaning when told first and may even have its origin in a science principle. Given enough time within a given civilization, a story with meaning may turn into a legend or myth. The story also travels from one civilization to another and from one continent to another. The travel changes the story's composition. Dilution with time is an inherent nature of information. Before we get to Hawking's story of the elderly lady in England and establish a Vedic connection to her Earth-Tortoise theory, let us first talk a bit about the nature of information itself.

# Entropy of Information

In the 'knowledge' exchange process between A and B the 'knowledge' is first converted by A into corresponding 'information' which is transferred to B who converts it back into the corresponding 'knowledge'. Because A

and B are dissimilar human-beings the knowledge at A is different from the knowledge at B.

Most effective medium of information transfer has been the verbal communication. The information transfer in this methodology is local and at the speed of sound. The modern information technology has changed the speed of information transfer from the speed of sound to speed of light. Therefore the information transfer now is quite instantaneous, global and more accurate. Even then the conversion of information to knowledge renders a differential between the knowledge at A and B. This could be viewed as the knowledge at A being the 'cause' and the knowledge at B its 'effect'.

Under the Vedic cause-effect principle, '*the effect is the vikaar of the cause*', where the term *vikaar* represents the order of state lower than the one existed in the original cause. It could be expressed in physics terminology as - '*the effect is a degenerate state of its cause*'. Simply put, the knowledge at B is at a lower order than the knowledge at A. This is like the principle of entropy in thermodynamics according to which the 'disorder' in a system always increases.

The factors responsible for introducing 'disorder' in the information-system (knowledge) are time, locale, language etc. Before the modern technological development took place the information took hundreds or thousands of years to cross the borders of the countries. Although slower, the information did travel in those days too. Just as the cause-and-effect is an underlying principle in the functioning universe where cause precedes the effect and just as the physics principle of entropy is inherent to physical systems in nature where disorder increases with time, a simple information-entropy theorem could be formulated as:-

**"The entropy of information increases with time"**

The increase in information-entropy is also subject-specific. For example the information-entropy increases faster in the realm of history of a society than in science. This difference is owing to the fast changing rules governing a society compared to the non-variance in the rules of science. The older the history of a nation the higher is the degree of uncertainty for ascertaining the 'true' history and historical events of that nation as well as the 'truth' about its civilization. Just as in studying the physical system that

we call 'universe' a Big Bang cosmologist begins with some seemingly logical assumptions on its present state (present entropy) and goes back in time to predict its beginning in a space-time singularity, a historian goes back in time to put together a society's history, based on the information of the present and in the near past. The common process in the two situations is the extrapolation back in time.

For any extrapolation, one needs reliable data points on the timeline of the history itself. Such data points in the case of the history of a society, a culture or a civilization generally are in the form of hints, verbal accounts, stories, references in the books as well as the facts preserved in the written records; the latter furnishing high reliability. There is always a probability for misinterpretation. This is equivalent to the increase in information-entropy. A higher degree of entropy is introduced in the information when a historian attempts to write the history of a civilization with his mediocre command of that civilization's language, literature and culture. This in fact has been the situation when the Vedas, Vedic Literature and the Vedic Civilization's history were interpreted by some Western Indologists and Sanskritists of the past couple of centuries. Reliability of these historical deductions increases when the historical records prepared by the historians of the past belonging to the civilization are interpreted by competent present historians from the same civilization. History will be more reliable when it is based on the writings of the historians of that culture who lived closer to the historical events in that culture, establishing the validity of the history and events.

The Vedas, Vedic knowledge, Vedic philosophy and Vedic history, having their roots in the far antiquity of the Vedic Civilization of the Aryans in India, have suffered from increased information-entropy owing to the fact that a long time period has elapsed since their advent. In this process the information about the value of Vedic thought has gone through an unnaturally high entropic change. The entropic change seems to have shaped the narration of Hawking's story of the elderly lady and her Earth-Tortoise Theory.

## Hawking's Story of the Elderly Lady and her Earth - Tortoise Theory – How myths get Created!

It is in human nature to want to know more about the universe and then to tell others about it. How best to tell for most to understand has always been a challenge for all civilizations. So that others can understand, the persons with relevant knowledge have resorted to examples, similes and metaphors. No matter how complex the knowledge is, it comes down to the person of knowledge turning into a story teller. Hawking, Sagan and some other popular science writers are good story tellers and have helped common people to understand a lot about the universe. However, the answers to basic questions about the universe continue to lie in the realms of complex mathematical formulations and concepts in quantum mechanics. This too must be brought to the level of a narration for the benefit of the others.

In telling the story of cosmology, Stephen Hawking in his earlier book entitled 'A Brief History of Time' narrated an interesting story as:

> *"A well-known scientist (some say it was Bertrand Russell) once gave a public lecture on astronomy. He described how the earth orbits around the sun and how the sun, in turn, orbits around the center of a vast collection of stars called our galaxy. At the end of the lecture a little old lady at the back of the room got up and said: "What you have just told us is rubbish. The world is really a flat plate supported on the back of a giant tortoise." The scientist gave a superior smile before replying, "What is the tortoise standing on"? "You are very clever, young man, very clever" said the old lady, but it is turtles all the way down!"*

This author feels that under the humor of the earth-tortoise story is hidden some science with its origin in ancient India because similar stories have been prevalent in the Indian countryside. It can also be said that the stories related to the Earth and the creation of the universe that are narrated by the farmers sitting around a fire began as a lesson in science contained in the Veda mantras. Slowly, as the millennia passed, the information-entropy did its job and the science lesson changed into the earth-tortoise myth narrated by the old lady. Loss of the source of information (story) with time is natural, as in Hawking's story; "…*some say it was Bertrand Russell*" indicates a hint of uncertainty. By the time Hawking told the story in his

book there are three stories in one - first is the old lady's earth-tortoise story, second is the story of the encounter between the elderly lady and the well-known scientist and the third is about the first two stories that Hawking is telling us in his book. Obviously the 'information-entropy' has been in play beyond just the A and the B mentioned above.

As a child this author had heard the stories related to the Earth, the Sun, the constellations and the cosmos from elderly farmers sitting around a fire, continents away from the stage of Hawking's story in England. Some said that the Earth was supported by some extraneous entity, some said that it was supported on the back of a turtle exactly as in Hawking's story of the elderly lady and some said that it was supported on the hood of a cobra. Others said that it was supported on the horn of a bull. The farmers even had their own cosmological theories for the creation of the universe. When this author acquired higher education, including the study of the Vedic and Puranic literature, the source of the village myths became obvious. The 18 books of Puranas are the source of Hindu mythology.

The ancient Vedic Literature is vast and the references to the word 'turtle/tortoise' would be many. The author would address just a few pertinent to the subject at hand: the 'earth-tortoise story'.

The Sanskrit word for tortoise is *koorm*. The earliest appearance of the word *koorm* is in RigVeda. It is in the name of the *rishi*, Koormo Gaartsmado Gritsmado Va (son of Gritsmada) who is credited for the revelation of 35 mantras in three *suktas* (hymns or sections) with 31 other full *suktas* credited to his father Gritsmada. These mantras, revealed by both of these ancient *rishis*, are on the subjects (*devatas*) that relate to the Sun, the air system (atmosphere), the Earth-Space system, and the energy and so on. Therefore, when a reference of these subjects is made in Sanskrit Literature it is natural to state that the particular knowledge regarding the Sun and the Earth is based on the revelations of Rishi Koorm, who in fact is a scholarly man and not a turtle.

This is something similar to an expression in modern cosmology for the phenomenon of gravitation. Often we read - '*Gravitation is better explained by Einstein's theory*'. We know what it means and it is unaffected by the information-entropy to interpret it differently. But this expression would have a different meaning in an imaginary scenario thousands of years from now if a cataclysmic event wiped-out the present civilizations on Earth, gone with it the entire science development. If the German language

was still alive after the cataclysm and someone read the above mentioned sentence, he could translate it as - "*gravitation is better explained by one-stone theory*", because the compound word '*einstein'* could be interpreted as *ein + stein* which means *one-stone*. Or it could also turn into "*gravitation is surrounded by stone"*, because *einsteinen* means '*to surround with stone*'. With time and even without a cataclysmic event a Vedic statement - '*knowledge of Earth is based on the revelation of Koorm* (the *rishi*)' could turn into a myth that the Earth was on a *koorm* the turtle. Therefore this could be a source of the earth-*koorm* or the earth-tortoise myth that this author also heard from the farmers.

The Vedic Literature that followed the Vedas has used the word *koorm* for a tortoise and as an adjective for describing the shape and properties of objects. In the book of Mahabharata, the compound word *koorm-prashthaka* is used for the lid of a dish, for it is in the shape of a turtle's back. The other words with *koorm* as prefix are: *koorm-kalp* (an ancient period of time), *koorm-chakra* (a geometrical circular drawing), Koorm-Purana the 15$^{th}$ of the 18 Puranas that are laden with mythological Hinduism.

Pertaining to the subject at hand, the 15$^{th}$ Purana with the title - 'Koorm-Purana' is on the reincarnation of Vishnu as a tortoise. The term *vishnu* in the Vedas stands for the '*creator and the upholder of the universe*'. The Puranic interpretation said that the Earth is upheld on Vishnu the Koorm (tortoise). This is one other source of the myth that the Earth was resting on a tortoise.

Two adjectives for the Earth, *koorm-prastha-nibhaa* meaning "*like-turtle-back*" and *koorm-prashtha* meaning "*hard and sloping in all directions like the shell of a turtle*" were presented earlier. These adjectives for the Earth, delineating the scientific observation of the Earth by Rishi Gritsmada, could also be the source of the earth-tortoise myth. Instead of the intended meaning of the earth-tortoise simile for the spherical Earth, the possibility of the simile taking the form of a myth was high and the possibility of it turning into folklore was there. There certainly was a possibility for such folklore to reach the lecture hall of Bertrand Russell in England. In my village, since the time I heard the earth-tortoise theory first, independent India progressed and the education also progressed. The younger generations have brought new knowledge to the villages. The

earth-tortoise theory has faded away along with the supporting tower of tortoises.

Another example of a Puranic story built on the distortion of a Veda mantra is that of the Earth sitting on the head of a cobra. A Vedic mantra states that the Earth is '*sarpvati'*; the actual meaning is that the '*Earth moves like a serpent'* or that the '*Earth is in serpentine motion*'. While the sliding of the Earth in space is a scientific fact emanating from the Veda, the misinterpretation of the mantra could create a myth.

Sanskrit generates synonyms with each name representing a property and Sanskrit also has multi-meaning words such as '*indra'*. The word *indra* stands for God in the spiritual and creation realm, it stands for the Sun in the physical and cosmological realm and it stands for a king in the social realm. Not following this important nuance could lead to creating a myth!

The Earth in the Veda is described as *agni-garbha* (pregnant with heat/fire); a simple observation of volcanic eruption could lead to such an adjective - a fact. The Earth in a myth is supported on the horn of a bull - not a fact. This myth could have come from mistranslation of the two RigVeda mantras (1/164/47 and 1/146/2) wherein the Sun is addressed as *ooksh* and credited to be the cause for the rain on the Earth (a scientific fact in the Vedas). The two RigVeda mantras (1/164/47, 1/142/2) state-

"*O man, know the sequence of cause-effect for the Earth getting wet by rain. The rays of the brilliant Sun cover all waters of the Earth, attract (raise) water in space and send it in flight to wet the Earth"*. (RigVeda, (1/164/47).

"*The Ooksh* (Sun), *bigger than the Earth, is responsible for creating clouds and sprinkling water drops* (in rain) *and thus the Earth surface gets impregnated for the birth of vegetation*". (RigVeda, 1/142/2).

The word used for the Sun in the last mantra is *ooksh*. There are several other mantras, RigVeda (5/47/3, 10/31/8), that have used the *ooksh* synonym for the Sun. The mantras (RigVeda, 1/142/2) states clearly that –

"*… the Sun is bigger than the Earth…* the *Earth is in space and is supported by the attraction of the Sun...*".

Since *ooksh* the Sun is said to be supporting the Earth, there is a high likelihood of a myth originating out of these mantras - that the Earth was supported by an ox. An interesting point to note here is the similarity in the sound of the Vedic term *ooksh* impregnating the Earth's surface and the word ox impregnating a cow. One wonders, how the word oo*ksh* travelled to other languages still sounding more or less the same. The Earth-bull relationship is a scenario in some other religions also.

## Hawking and the Universe Out of Nothing - Contradicts the Saankhya Philosophy

Prof. Hawking in his recent book, 'The Grand Design', coauthored with Prof. Leonard Mlodinow, a physicist at Cal Tech in USA, touched the subject of theism/philosophy. Let us look into the logic of the statement well-publicized in the media:

"*…Big Bang was merely the consequence of the law of gravity and God no longer has any place in theories on the creation of the universe due to a series of new developments in physics…*".

To say that '*God no longer*' has any place in theories on the creation of the universe may imply that at some point in time the God was part of some cosmology theories and now God is taken out of the theories or that the theories with God are now proven wrong. It is common knowledge that neither the religions have ever attempted to prove God through mathematical equations nor physicists have attempted in their equations and experiments to prove or disprove God. The reality is that the physicists cannot provide a direct proof of some of the entities that they believe exist, the Time and Space are such entities. If God never was a part of any Big Bang field equation then to say that "*God no longer has any place in theories*" has no strong logic.

Even the part statement – "*Big Bang was merely the consequence of the law of gravity…*" has no solid logical basis when the fundamental questions related to the Big Bang Hypothesis raised throughout the earlier text in this chapter and more raised in Chapter 2 remain unanswered: why is

there mass in matter and the gravitational property in mass, when did Nature perfect its laws, what are the Time and Space made of and so on. The Big Bang Hypothesis itself is not based on pure mathematical equations either. They are a parameterization in a mathematical construct which once setup could churn out a desired universe. Or churn out as in Multiple Universe Theory as many as $10^{500}$ (500 zeros after 1) different universes. With a large number of questions outstanding can one conclude that the gravity alone created the universe?

An example of an inconceivable situation in Big Bang Hypothesis, as pointed out earlier, is the Cosmic Inflation Era when the matter of the universe is made to rush out at un-natural and un-imaginably high speeds of $3.33 \times 10^{21}$ times the speed of light (details in Chapter 2), the speed of light being $3 \times 10^8$ m/sec. Nothing in the universe is supposed to travel faster than light. A weak explanation for this strange behaviour of matter came from Hawking's co-author Leonard Mlodinow. Mlodinow at a CNN panel discussion said that the '*time does strange things*' in those early moments of the universe.

On September 10, 2010, the host on the CNN television, Larry King, held a panel discussion on Hawking and Mlodinow's new book entitled "The Grand Design". The panel included the well-known authors: Leonard Mlodinow, Deepak Chopra and Father Robert J. Spitzer. Prof. Hawking did not appear on the television but his answers to Larry King's questions appeared in the videos forwarded by Prof. Hawking. It was one of the most captivating panel discussions on CNN. Regarding the Time-entity, Mlodinow stated:-

*"Well, the question of time is also one that you have to be careful about; …time can become part of space. Time and space affect each other. As you go back in time, when the universe is very, very small, time ceases to have the meaning we think of it as having today. You can't really go back -- you can't follow time backwards like it's a railroad track and get to the station and that's the beginning. So that question of what's time zero is a difficult question to phrase."* (**script from CNN**)

This statement pertains to the Time-entity, yet it does not deal with the nature of Time. The first part of the statement suggests that as one goes closer to the beginning of Time (in the Big Bang Hypothesis) it becomes a

part of Space and both start to affect each other. Mlodinow's statement raises more questions than provides answers. When cosmologists do not know yet what Time and Space are made of at their fundamental level, can one claim that the Time and Space are affected by each other when Time approaches zero? Do tiny parts or corpuscles of Time or Space, if they are made of corpuscles, combine to form something else or do they consume each other to affect each other? What exactly is this effect that Mlodinow is referring to? Why is Time so small when the universe was small and what physical, chemical or biological mechanisms make Time to grow? The matter is created under the laws of Quantum Physics but under what law or laws the Time or Space are created?

If Time and Space affect each other when Time was close to zero, should they not affect each other in the same way now when they are still growing and embedded into each other at each and every minutest possible point in the universe? These are simple questions and their answers ought to be simpler than – '*So that question of what's time-zero is a difficult question to phrase'* as in Mlodinow's above statement. Even now after 13.8 BY, the age of the universe, one is not able to cut a piece of Time to measure it separately and save it, away from the main Time. The same goes for Space. If two tiny pieces of Time and Space cannot be cut and tied together in a physics laboratory of today, to form a tiny 'space-time continuum', it seems futile to think that Time and Space in the physics laboratory of Nature formed a tiny 'space-time continuum' at time-zero of Big Bang when "… *time can become part of space. Time and space affect each other"*, as stated by Mlodinow.

In Mlodinow's railroad track metaphor that – "*You can't…..follow time backwards like it's a railroad track"*, a station is implicitly conceived at the "space-time singularity" from where the train started but cannot go back to. What effect makes it an irreversible process? If the track in the metaphor were a Canadian Pacific Railway stretching over 22,500 km through about 1,300 stations, all stations are reachable! What if there were many stations on the other side of the so-called last station named "space-time singularity"? Unless proven otherwise the Time-entity could even be an eternal entity flowing from well beyond the station called the "space-time singularity". The same goes for the Space-entity. Therefore, a logical statement would have been that one is not able to follow time right close to t = 0 second owing to the limitation in the Big Bang field equations wherein

the mathematical algorithm becomes unstable. The fact is that nothing physical should happen to the Time-entity itself at the beginning of the assumed Big Bang. Therefore, to say that the '*time does strange things*' near t = 0 second is not based on sound logic. Also to say – "*time ceases to have the meaning we think of it as having today"* is also not based on sound logic because there is no proof to such statements. There is some degree of circularity in Mlodinow's argument because the Time is dealt with in specific equations with a pre-thought of specifically ending it into the space-time singularity at t = 0 sec; but that is happening only in the equation of a cosmologist and not in reality.

The Big Bang Hypothesis first works with Quantum Physics to create matter for a negligible part of the universe's age and then works with Einstein's Theory of General Relativity for the rest of the universe's long life of 13.8 BY and continues beyond that. In this process there is no overlap (no unification) between the Quantum Physics and the Theory of General Relativity. Just for fun, if one were to take a reverse journey right up to the 'space-time singularity' at time zero that would be like tracing back the history of the universe. In order to take up this reverse journey, the caravan of time, space, matter, energy gravitation and Dark Energy, the 'camel-tied to the tail of the camel', follows the rules of General Relativity for most of its journey. This caravan carries the cargo of General Relativity back in time towards the first moments of the Big Bang, however, before reaching the space-time singularity the cargo will be forced to pass through the torturous 'time-warp' in the desert of Cosmic Inflation! Then the cargo of General Relativity must be left at the doorstep of the Planck Epoch just $10^{-43}$ seconds away from the birth of the universe!

A camel of General Relativity is too big to enter the minute nursery of Nature named the Planck-time regime where the nurse named Quantum Mechanics works and would not permit even the tail of the camel to pass! Physics has yet to develop a conciliatory relationship between Quantum Theory and Gravitational Theory (General Relativity). Effort is being made in Particle Physics (Quantum Mechanics) through developing a Unified Field Theory to reconcile the two. There has not been measurable success in this area yet. Contrary to Hawking's statement, the fact remains that the General Relativity is not even effective in the Quantum Mechanics regime near the space-time singularity and the law of gravity not being operational in Quantum Mechanics is not even the initiator of the early universe in

Planck-time epoch. Therefore, to state emphatically that "*Big Bang was merely the consequence of the law of gravity…*" is not strictly logical.

Hawking's much quoted other statement is:

"*Because there is a law such as gravity, the Universe can and will create itself from nothing. Spontaneous creation is the reason there is something rather than nothing, why the Universe exists, why we exist. It is not necessary to invoke God"*

A similar emphasis at the panel discussion on CNN came from Mlodinow*:*

*"…One of them is this concept of nothingness. According to quantum theory, there is no such thing as nothingness. You can have nothingness in quantum theory. But from that, things will arise. You'll pop into existence and out of existence again. So I know that's hard to understand and hard to accept…."*.

When Larry King asked - So there can be a nothing? Mlodinow replied-

"*So there's nothing, but nothing is not stable. Things come and go from nothingness*."

Hawking's above premise hinges on the existence of the 'law of gravity' and the 'spontaneity of matter creation out of nothing'. According to Quantum Physics the Higgs particle imparts the mass to other matter particles just created and the mass in turn creates the property of gravity in matter. Therefore, in the sequence of creation the spontaneous creation of matter, including creation of Higgs particles that impart mass to other particles just created, is primary and the creation of mass and law of gravity is secondary. An implicit assumption in this logic seems to be that God is incapable of spontaneity. The theists have always believed the *spontaneity* as an attribute of God. On the other hand the law of gravity is not known to act with *spontaneity*. Regardless of whether God exists or not, Hawking's premise at face value is not logical.

According to the Vedic Big Bang (discussed in Chapters 6 through 9 in Volume 2), the properties of matter, including mass, are invoked when the *Asata*-state of undefined matter transits into the *Sata*-state of defined

primordial matter. The *Sata*-state of matter forms a primordial matter conglomerate in ovate shape named *Hiranya-garbh* (Golden-embryo) which over a Veda prescribed period of 4.32 million years (one *deva-yuga*) develops enormous heat and rotational energy. Then the 'spontaneous' Big Bang took place with a tremendous explosion in the Golden-embryo. That it was a spontaneous explosion is stated in the RigVeda mantra (10/129/5). The *sukta* (hymn) 129 is entitled "*Bhavavrittam*" meaning the "*History of Creation of the Universe"* –

*"At the onset of creation, there is* विततः *(vitatah) the instantaneous-expansion of the rays of* रेतोधाः *(retodha) the fundamental seeds of matter omnidirectional, interlaced transversely all-around, existing above as well as below…*".

The Vedas being theistic**,** विततः *(vitatah)* the *instantaneous-expansion* is credited to the Creation Energy Field addressed as God. The spontaneity therefore is not a necessary condition for eliminating God from the creation process of the Big Bang Hypothesis.

A reference to God in these pages may give an impression that this author is making an effort to defend the concept of God. This is not the case. The effort here is to show that a sensible serious consideration to the subject of cosmology exists in ancient Veda mantras as far back as one can go in the ancient civilizations on Earth where God happens to be a part of that theistic frame of reference. The author's emphasis in this book is on "material-cause" the Nature (matter/energy) along with the "efficient-cause" (God) and the "general causes" such as the Time and the Space. The aim is to bring in mantra references on cosmology, just as a cosmologist would bring in references from the work of other cosmologist, an atheist or a theist. The emphasis is on the thought contained in the mantra rather than on pedant. If one so wishes, God could be dropped from the Vedic scenario because what will still be left are the matter (Nature-entity) and the physical mechanisms that create and shape the universe. The Vedic scenario is not like – let there be universe and the universe was there. For example, another reference (Shatpath Brahmana, 11/1/6/1, 2) states that the brilliantly-hot golden embryo made of primordial matter in ovate shape was in *paryaplav* (rotation around an axis while in floatation) for a period of one *deva-yuga* measuring 4.32 MY before it exploded spontaneously. This Vedic scenario (in Chapters 8, 9) is as neutral without invoking God as physics is.

Many Veda mantras pertaining to Vedic Big Bang deal with physics without invoking God. The 'material-cause' (Nature) of the universe still remains the same whether it is in a Veda mantra or in modern cosmology. The bulk of the above mantra delineates the instantaneous expansion of the rays of fundamental matter particles going in all directions. The brilliant use of the Sanskrit term representing *interlacement* of all matter (rays of matter) further emphasizes that in spite of the sudden explosion in Nature, all matter remains connected. This is a fact of the universe, emphasized in modern cosmology as well. The all-pervading attractive force of gravity owing to the mass in matter of the universe ties together all the mass of the universe.

In the second part of the mantra cited above, the reference is made to both, the conscious-being Creator and the inert Nature with its synonym *Svadha*, which means – a '*self-existent entity*', an eternal entity. The Vedic terms for Nature in its primordial matter and energy phase are adorned with specific adjectives**:** *Hiranyam-aand* (Golden-ovate); *Hiranya-garbh* (Golden-embryo); *Maart-aand* (the Mortal-ovate); *Braham-aand* (Brahmn's ovate) and *Prajapati* (Progenitor and governor of the population, the cosmos) (RigVeda, 10/127/9; 10/168/3; Shatpath Brahmana, 11/1/1, 2). This rich terminology itself begins to delineate the creation scenario of the early universe, which has several similarities with the modern Big Bang Hypothesis.

The process of spontaneous explosion in the primordial matter leading to the advent of the universe therefore is not a necessary condition limited to an atheistic reference frame only. The वितत: *(vitatah)*, *instantaneous-expansion* in the RigVeda mantra (10/129/5) and several other mantras presented in Chapters 7 to 9 represent only a physics process without religious connotations. The important point here is that the Veda put forward the process eons before the modern Big Bang. When one is dealing with a physical process in Nature, *it is not necessary to invoke God* as Hawking stated, but when one wishes to look into 'cause-effect' a theist traces back to the 'efficient-cause' and 'material–cause' whereas an atheist traces back only to the 'material-cause' and the God is replaced by "spontaneity".

The statements of Hawking and Mlodinow, "*Universe can and will create itself from nothing*" and "*… You can have nothingness in*

*quantum theory. But from that, things will arise"* imply that an 'effect' need not have a 'cause'. Therefore effectively these statements are in contradiction with the age-old deductions in philosophy, Eastern as well as Western, wherein the principle of 'cause-effect' is seen as a natural principle.

A dictum under the "cause-effect" principle in Vedic Philosophy stipulates that –

***"What is being created cannot be a cause of itself".***

Therefore if Time, Space and Nature (matter), all three entities with different characteristics and properties, are created for the first time in the Nature's experiment called Big Bang, then creating all three without a 'cause' or 'causes' means an indulgence in pseudo-science!

There is some discussion pertaining to this subject in contemporary published literature. One example is an article in the British Journal for the Philosophy of Science (pages 649-668, 45, 1994) by Quentin Smith. He has addressed a question- "Did the Big Bang Have a Cause". He refers to William Lane Craig's contention from *The Kalam Cosmological Argument* (Harper and Row, pub. 1979, p. 145) that- '*everything that begins to exist has a cause of its existence*' and finally Smith concludes thus:

> *"…there is no sound Kantian-style argument that the big bang singularity has a cause. I am not aware of any other even remotely plausible a priori argument that the big bang has a cause, and so I think it is reasonable to conclude that the prospects for such arguments are poor. …Thus we reach a general conclusion: there is no philosophy of big bang cosmology: that the universe began to exist without a cause*."

Quentin Smith refers to Immanuel Kant (1712-1804 CE) the well-known Kaliningrad (Russia) philosopher with German background. Kant is considered to be a German philosopher of high scholarship. It is also well-known that Kant had deep interest in Indian philosophy as well as in Sanskrit language. According to the Soviet scholar Theodore Stcherbatsky (1866-1942 CE), a Russian Indologist, Kant derived his doctrine of the '*categorical imperative*' from none other than the Hindu philosophy, which

is the same as the Vedic philosophy. The Nobel laureate Ravindranath Tagore and Pundit Jawahar Lal Nehru praised Stcherbatsky for his scholastic achievements in Hindu and Budhist philosophies and his fluency in the Sanskrit language. There were well-known writers and philosophers who followed Kant, such as August Wilhelm von Schlegel (1767-1845 CE) and Friedrich von Schlegel (1772-1829 CE). Both brothers pioneered the Indo-European linguistics and comparative philology in Europe.

Kant's doctrine, the '*categorical imperative*', states:

> "*It is impossible for anything to begin to exist and that every change is an alteration in the state of some permanent substance*".

Kant formulated this principle about two hundred years ago. Contrasting with this is Quentin Smith and most modern cosmologists who argue that the Big Bang happened out of nothing, without a 'cause'. If for a moment one puts aside Smith's argument related to Big Bang and looks at Kant's doctrine from the Vedic frame of reference, one is certainly up for an unanticipated surprise.

If this author were to take the reader into the distant past of the Vedic Civilization well beyond the historical milestone of 5,200 years ago and open the first chapter of Rishi Kapil's Saankhya Darshan, the 43rd *sutra* therein states,

**नावस्तुनो वस्तुसिध्दि**: ।(*Naavastuno vastusiddhi*) (Saankhya Darshan, 1/43)

**Sutra translation**:

"*Nothingness cannot be the cause of something*". (Saankhya Darshan, 1/43)

Rishi Kapil's above statement is in the context of the creation of the universe. The Vedic Creation Principle is based on RigVeda's 129th *sukta* of its 10th chapter and it is formulated in Chapter 6 of this book. As expressed earlier the universe comes into existence owing to the transition of the state of matter (Nature) from *Asata*-state (indefinable state) into the *Sata*-state (definable state). A direct implication of this is that something as real as the

universe is the 'effect' with its pre-existing 'material-cause' being the *Asata*-state of matter. Thus in the Vedic creation "nothingness" is not the cause of the universe. This is also Kant's emphasis in contradiction with those contemporary cosmologists who emphasize that the universe came out of nothing.

The most common term for Nature in Vedic Philosophy, including in Rishi Kapil's Saankhya Philosophy, is *Prakriti*, however contextually he has also used the term *Pradhaan* which means '*the primary-material-cause*'. Another expression of the *Asata*-state of Nature is the 'causal state of matter' which has a real existence.

Those arguing that the entire matter in Big Bang or any other piece of matter was created out of nothing, have to first disprove Rishi Kapil's principle that *"Nothingness cannot be the cause of something"*. Particle physicists argue that the particles and anti-particles appear all the time in their experimental chambers out of nothing and disappear into nothing. The observation of new particles in experimental chambers may be valid but their argument of 'out of nothing' is not on a sound basis because their definition of 'out of nothing' is quite arbitrary. Conjectures such as - 'the Big Bang had no cause', are in contradiction with the Saankhya Darshan's *sutra* **नावस्तुनो वस्तुसिध्दि**: (1/43) and therefore with Kant doctrine as well.

According to the Veda there is no place in the universe with a perfect vacuum. A so-called vacuum chamber of a physicist may be completely devoid of atoms of gases and other particles but it is still populated by the ubiquitous *aapah* matter, the most fundamental particles. In the creation process of the Vedic universe the entire universe is first filled with 7 *deva*-systems (discussed in Chapter 8) before the Vedic Big Bang takes place in the compact so-called 8$^{th}$ progeny of Nature named *Hiranyamaandam* (Golden-embryo). One of the 7 *devas* is the ubiquitous *Aapah-devata* forming the background field of most fundamental particles in triplet *sata, raja* and *tama* with differing properties (details in Chapter 5). They are so minute that they cannot be evacuated completely from a vacuum chamber. The term '*aapah*' means '*present everywhere*'. Then there is a part of the Space-entity, gravitational field and the Dark Energy (if it is real) in the same vacuum chamber; none of which could be evacuated out. Thus there is not a thing like '*nothing*' anywhere. Before claiming that the phantom particles appear out of *nothing* and disappear into *nothing*, a physicist has to think of all-pervading '*aapah*'. A statement such as the '*matter created out*

*of nothing'* is not logical because the matter is the 'effect' of a 'cause' that could be obvious or hidden.

A *sutra* (aphorism) in philosophy does not come out of a hat. It first springs up instantaneously, revealed as a thought in the mind of a *rishi* who ponders over it before formulating it. A quantum of thought may appear spontaneously in the mind but it does not vanish like a matter-antimatter particle pair of Quantum Physics annihilating in the next moment. The quantum of thought is expressed, correlated with observations, tested by logic and argued extensively, sometimes over centuries by other brilliant thinkers and ultimately the formless thought incarnates into an observable and readable aphorism. *Sutra*-aphorisms of Vedic Darshans are the ancient pearls of wisdom intercalated on the thread of brilliance and they never age. For the brevity of the text a lot more relevant material from the Darshans cannot be invoked here. In the context of cause-and-effect, only a limited number of *sutras* from Saankhya philosophy should suffice as following.

In relation to the creation of the universe, Rishi Kapil in his Saankhya philosophy, taking advantage of the power of the Sanskrit language, brilliantly formulates a concise *sutra* on the 'material-cause' and the 'cause-of-a-cause',

**मूले मूलाभावादमूलं मूलम् ।** (Saankhya, 1/32)

**Transliteration**: "*moole moolaabhaavaad-moolam moolam*".

**Word Translation**: मूले (*moole*) = in the mool**,** **मूलाभावात्** (*moolaabhaavaat*) = from nonexistence of *mool*, **अमूलं** (*amoolam*) = is without *mool***,** मूलम् **(***moolam*) = *the mool*.

**Sutra Translation**:

*"The mool is without mool due to nonexistence of the mool of the mool". (Saankhya, 1/32)*

In this outstanding intellectual display of the power of Sanskrit grammar, through the forms of the single term mool, Rishi Kapil has formulated a universal principle. A first read of the English translation of the sutra may not make sense because the same word mool is being used as the subjective-noun and the objective-noun. It is difficult to extract the actual meaning being conveyed by a sentence if its grammatical logic is unclear. The fact is that the sutra of Rishi Kapil with four parts (see transliteration) is a complete sentence and the sutra statement makes full sense right away

for someone with Sanskrit background even if the actual meaning hidden in the sutra may require further explanation. It is the power of the Sanskrit language that enables the single term mool in four variations of grammatical conjugations to convey the logical meaning of the sutra statement. To extract the meaning hidden behind the words one requires some background-reading of the interpretive commentary and the knowledge of word formation. Therefore this author feels that a brief discussion on Rishi Kapil's sutra is in order here.

What is this *mool* that Rishi Kapil has so beautifully used in this *sutra*? The *rudhi* (ordinary/colloquial) meaning of the Sanskrit word *mool* is the root of a plant. The sprouting of a seed begins with a root which supplies nourishment to the plant. Thus the process of the root being the feeder to a plant, ranging from a micro-plant to a gigantic tree, is universal. Therefore implicit even in the ordinary meaning of *mool* is that a substantive root of a tree is the 'cause' and the substantive tree is the 'effect'.

The English usage of the word 'root' in a two-worded common expression - the 'root-cause', also conveys a similar meaning wherein 'root' is the adjective and 'cause' is the abstract noun. Its application for a tree may sound awkward if expressed as, the 'root is the root-cause for tree's existence', albeit that is a fact. A tree's existence begins from the first molecules of its root and its root continues to be the cause for its existence. Cut the visible part of a fully-grown tree and the probability is that it would sprout again, but if its root is cut off, its death is inevitable. This is why the root of a tree is the cause for its 'existence'. Obviously there are two kinds of effects caused by a 'root'– subsistent and abstract. The subsistent effect is the three dimensional physical tree and the abstract effect is the very 'existence' of the tree.

As mentioned before, all words in the Vedas and *sutras* have *yaugik* meaning (root-based, abstract), not the *roodhi* meaning that represents concrete objects. The 'existence' of a tree is the effect of a cause which is the root of the tree (*mool*). The 'existence' is the *yaugik* meaning of the effect. On the other hand the three dimensional substantive tree is the effect of a cause which is the root of the tree (*mool*). Rishi Kapil's *sutra* is to be treated in the *yaugik* realm where no substantive causes or effects are involved. Both meanings of *mool* are applicable and necessary to understand the soul of the *sutra***.** The usage of *mool* in this *sutra* is for the material-cause of creation which is the Nature itself, which Rishi Kapil has

addressed as *Prakriti* or *Pradhaan*. The rephrased English translation of the above *sutra* in familiar words is:

*"The Nature is without a cause due to nonexistence of its cause"* (Saankhya, 1/32)

The straightforward meaning of this statement is that the Nature is not caused by something else; it is without a cause. This by definition makes it an eternal entity. Because the Nature is the entire matter forming the universe, the Nature is universe's 'material-cause' (the *mool*). Matter being an inert substance the Nature in the Vedas is devoid of consciousness. The consciousness in the Vedic perspective is altogether a separate, non-matter, eternal quantum of consciousness that creates the observed consciousness in the otherwise inert conglomerate forming a living body.

The *mool* in Rishi Kapil's above *sutra* is not the quantum of consciousness (individual soul) because the *mool* of the Saankhya *sutra* (1/32) is the 'material-cause' of the universe, the Nature. Rishi Kapil in other *sutras* of his Saankhya Darshan has also dealt with the quanta of consciousness that serve as the cause for consciousness in living-beings. The *sutras* mentioned above, Saankhya (1/32, 1/43) and several more were established by Rishi Kapil to lead to the principle of eternity applied to certain entities in the creation process of the universe. The other two inert eternal entities serving as the 'general-cause' in the process of creation are Time and Space entities. The eternal entities that have no cause for their existence are addressed as *anaadi*. A detailed discussion on eternal entities is in Chapter 5.

The author of yet another Darshan (Philosophy) Rishi Kanaad, who gave the definition of *paramanu* the last stage of matter and the revealer of the property of gravity in Earth, deals with the subject of *kaaran* and *kaarya* (cause-and-effect) using his own unique perspective for terminology. Two relevant *sutras* are discussed below.

कारणाभावात्कार्याभाव: । (Vaisheshik, 1/2/1)

**Transliteration**: "*kaarn-abhaavaat-kaarya abhaavah*".

**Sutra Translation:**

"*In the absence of a cause the effect is non-existent*".

(Vaisheshik, 1/2/1)

Then in the subsequent *sutra* he stated the same principle completing the logical loop:

न तु कार्याभावात्कारणाभाव: । (Vaisheshik,1/2/2)

**Transliteration:** "*Na tu kaarya-abhaavaat-kaarana-abhaava*".

**SutraTranslation**:

"*The absence of effect does not prove the absence of cause*". (Vaisheshik, 1/2/2)

These principles related to the cause-and-effect are remarkably concise, yet they convey a complete meaning. In the context of the universe's creation out of Nature these two *sutras* together mean that if there was no Nature (cause) there would not be the universe (effect) and conversely the absence of the universe does not mean that the Nature (cause) was non-existent. For example in the dissolution state of the Nature when the matter is in the indefinable *Asata*-state confined in *tuchchhaya* (diminutive) space (RigVeda, 10/129/3), it is there but non-observable. This means that if the universe (effect) is absent, its cause is not necessarily absent. Rishi Kanaad's second statement (1/2/2) has a direct implication for the modern Big Bang cosmology wherein the birth of the entire universe is hypothesized from a dimensionless space-time singularity. It is counter-intuitive to think that a dimensionless space-time singularity served as the womb for $10^{60}$ kg of matter. If Rishi Kanaad's perspective prevails the Big Bang logic is in serious trouble. If Big Bang assumes that the universe was absent in the singularity at time zero it fails to prove that its cause (matter = Nature) was also absent in it. If the Big Bang Hypothesis emphasized that the universe first appeared as matter-antimatter out of nothing, then that 'nothing' is the cause of the universe. This argument is also in trouble, this time owing to Rishi Kapil's Saankhya *sutra* (1/43) that "*Nothingness cannot be the cause of something*".

It is interesting to note from the second part of Kant's statement cited earlier in this section, "…*that every change is an alteration in the state of some permanent substance*". In the present context of the universe his '*permanent substance'* is the eternal Nature-entity, the *Prakriti* of the Vedas

and Darshans. It may be noted that the Kantian maxim that relates to the preexistence of *permanent substance*, provides considerable value to the philosophical argument on the creation of the universe. It is concurrent with the eons old Vedic view expressed in the Upanishads and by the great *rishis*, Kapil and Kanaad.

It was mentioned earlier that the truth (*satya*) is invariant and non-transient. A conscious-being seeks truth because the truth leads to increase in knowledge. If a perceived truth brings with it some 'doubt', think that the truth is not reached yet. Doubt is the trait in conscious-beings that plays a vital role in uncovering the truth.

## Doubt (संशय = sanshaya)

The term for doubt in Vedic Philosophy is the संशय (*sanshaya*), defined by Rishi Kanaad in his Vaisheshik Darshan (2/2/17). Till the *sanshaya* (doubt) about a substance or a phenomenon exists in the mind of a person, the person cannot claim to have true knowledge of that substance or that phenomenon. Doubt blurs the mind.

To remove doubt one must understand what doubt is and how doubt arises. The great Vedic philosopher Rishi Kanaad brilliantly defined the *sanshaya* (doubt) as:

**सामान्यप्रत्यक्षाद् विशेषाप्रत्यक्षाद् विशेषस्मृतेश्च संशय**: ।

(Vaisheshik, (2/2/17)

**Transliteration:** "*Saamaanya-pratyakshaad vishesha-apratyakshaad vishesha- smriteshcha sanshayah*."

**Sutra Translation:**

"*Cognizance of ordinary nature of a substance (dharma, properties), non-revelation of its extraordinary nature (properties) and retrospection of its specific nature (properties) is 'sanshaya' (doubt) of the substance*". (Vaisheshik, 2/2/17).

Notice that in Rishi Kanaad's definition of *sanshaya* (doubt), the *sanshaya* is part of the substance. When the substance goes out of the mind

of the person the *sanshaya* (doubt) of that substance also goes with it. The doubt arises in the mind due to the incomplete knowledge of the substance. Doubt will not arise if there is complete absence of the knowledge of the substance (or entity). This means that doubt about a substance arises when the knowledge of its ordinary properties is already there but there is ignorance about its extraordinary properties that are not obvious and the mind recalls the possibility of some unusual properties that the substance may possess.

Based on Rishi Kanaad's *sutra* (2/2/17), this author draws two straightforward deductions:

(1) "*Doubt about a substance is generated by incomplete knowledge of that substance*", and

(2) "*Complete knowledge of a substance neutralizes all doubts about that substance"*.

This chapter began with Professor Carl Edward Sagan's quotation with half a dozen questions about the universe including the question - *why there is a universe*? This author has also raised a large number of other questions in this chapter on the universe and on the modern Big Bang Hypothesis. When there are unanswered questions about an entity, the entity is not absolved of the संशय (*sanshaya*) the doubt that it evokes. So is the situation with the universe. It would be difficult to remove all doubts about universe because it is complex, vast and unfathomable.

As we continue to learn about the ordinary properties (Rishi Kanaad's *saamaanya*) of the universe and learn about its extra-ordinary properties (Rishi Kanaad's *vishesha*) the doubt about the universe will diminish. But this cannot happen without the *retrospection of its specific nature (properties)*.

## Other Considerations in the contemporary Big Bang Hypothesis

Some contemporary Big Bang cosmologists have added to the *sanshaya* (doubt) about Big Bang Hypothesis. They believe that Time must have existed before Big Bang. Gabriele Veneziano published an article

entitled “The Myth of the Beginning of Time” in Scientific American, May 2004. In the article he stated- “ *Strings Theory suggests that the big bang was not the origin of the universe but simply the outcome of a preexisting state*”. In this scenario the Big Bang is not the beginning of Space and Time. He further stated that “*The new willingness to consider what might have happened before the bang is the latest swing of an intellectual pendulum that has rocked back and forth for millennia”* . Through the rigors of mathematics, some cosmologists as well as Paul J. Steinhardt at the Princeton Center for Theoretical Science at Princeton University, USA, are now working to prove the validity of the cyclic universe where a perennial cycle of expansion and contraction gives birth and death to the universe. The basic idea in this new development in cosmology is the same as in the ancient Vedic principle with the universe in the cyclic state, clearly laid down in the Vedic mantras. The contemporary cosmologists had to accept that if Time existed before the Big Bang of the present universe the Space also must have existed and therefore the other sequential Big Bangs must have occurred before the present one. Then who can arguably deny that the Nature, Time and Space are eternal entities? This already is the Vedic Big Bang Scenario. The extension of logic would render that the Big Bang was a recurring phenomenon. This leads to the matter being the material-cause and the Time and Space being the associative causes. In such a theory by contemporary cosmologists, the efficient-cause (the Creator) is out and the mathematics is in and the rest is the same as the Vedic Cosmology Principle. The argument in this situation is that if the creation is cyclic and if it is going to happen one after the other, where is the need for a Creator?

A long answer to this question needs a separate discussion; however a short point is made here. The Nature follows the law of gravity owing to the mass in matter. The mass in matter according to the Big Bang quantum mechanics came from Higgs particle in a later step of creation. So the mass in a matter particle, say an electron, is extrinsic to electron. Therefore for a moment not worrying about the other properties of the electron, an electron has two things in it the negative charge and the mass imparted by a Higgs particle. Because the mass is extrinsic to what the electron was, it should be separable from the matter of the electron. But a physicist is not able to separate mass from an electron or any other piece of matter. Then the question is – what is mass and when did it evolve to have attraction to other mass to create the law of gravity. In a Big Bang all things happen

instantaneously and there is time for sequential events but there is no time for evolution of any of the four forces in Nature and there is no time for evolution of all created particles. So, first time within the first moment (Planck-time) all matter diversity and all laws of Nature turned out to be just right with the criticality in their values. Can a physicist create only the property of mass in the laboratory or separate the mass from a matter particle? Can a physicist observe the Nature resorting to these actions now and indulge in evolving the process for further perfection? Because there is no sign of Nature evolving and arriving at the critically balanced Nature`s laws and the laws do not seem to be the outcome of a random draw, the only answer seems to be that the inert Nature is not alone and its different properties are extrinsically put into it.

From a theistic Vedic perspective, because the properties in matter are not seen developing in Nature (not evident from the behaviour of matter), they are extrinsic for someone to own them. The Veda credits the Creator for two sets of laws, *satyam* and *ritam*, which govern two realms of the creation - physical and spiritual respectively (discussed in detail in Chapter 5). A Creator is needed to infuse all matter properties to the inactive indefinable *Asata*-state of matter at the point of the commencement of the creation. Because He is all-pervasive each fundamental particle gets triggered with *satyam* and *ritam* laws.

## Hawking, Grand Design and the Veda Mantra

The Grand Design proponents have argued that the Nature's laws together with the values of solar mass, Earth-Sun distance and other factors are so critically balanced that life exists on Earth and small variation in them would not allow life to exist on Earth. They credit this to divine design, popularly known as the Grand Design. Because life thrives on Earth and presumably not on other planets of the solar system the proponents of Grand Design said that the Earth is uniquely created by the Grand Designer. Hawking wrote his latest popular book entitled - "The Grand Design", wherein he stated:

> *"The 1992 discovery of a planet orbiting a star outside our own Solar System is a turning point against Isaac Newton's belief that the universe could not have arisen out of chaos… That makes the coincidences of our planetary conditions -- the single Sun, the lucky*

*combination of Earth-Sun distance and solar mass -- far less remarkable and far less compelling as evidence that the Earth was carefully designed just to please us human beings".*

If the Grand Design implied that the Earth is special and the only planet in the universe to have life on it, the Grand Design with exo-planets discovered now in thousands has shot itself in the foot. Hawking's basic argument seems to be that if other solar systems may have Earth-like planets with life on them, then where is the need for God to specially design the Earth?

Hawking's argument is meaningful only if life existed on some exo-planets. The Grand Design continues to persist because life on exo-planets has not been proven yet. From the Vedic perspective on life on Earth and on the other planets both sides are only half right!

If the Earth-like exo-planets are already discovered in large numbers in other solar systems, within our reach with a telescope, it could be generalized that life exists throughout the vast universe. This would strengthen Hawking's argument that the Earth is not unique. But at the same time it puts the argument in jeopardy because if life exists on exo-planets, the possibility is that by now the intelligent-beings on them have proposed their own Grand Design. This makes the Grand Design argument to continue, now universally. The proponents of Grand Design do not come out a winner either because the exo-planets with life on them make the Earth a just another planet with life on it. So both are half right!

There is a positive side to this for the followers of the earth-centric Grand Design. If the astronomy had not discovered exo-planets with the possibility of life on them the believers of earth-centric Grand Design would not have had the benefit of learning that the Master Designer is capable of creating planets throughout the universe that give opportunity for living-beings to take birth on them and do their karma.

This argument does not make a difference to the followers of Vedic Philosophy because the Vedas have already enlightened them through mantras stating that the exo-planets exist throughout the universe that are inhabited by living-beings. There are numerous mantra and *sutra* references in the Vedic Literature that explicitly state that there are planets, seen and unseen that are inhabited by living-beings. Let us begin with a YajurVeda mantra (17/2) stating that living-beings are also born on the planets in the

universe other than the Earth. The YajurVeda did not come up with such a pronouncement to counter Hawking or the proponents of Grand Design, it has always been there since the ages. Therefore in Vedic science the 1992 discovery of the exo-planet, as stressed by Hawking, is hardly a turning point.

The first part of the long YajurVeda mantra (17/2) teaches to count in a decimal system from 1 to $10^{18}$ (billion-billion) giving nomenclature for all divisions: 1, 10, 100,….till 18 zeros after 1. It is of interest to note from this *chhanda* (long mantra) that a decimal system for counting was established in the far antiquity of the Vedas. The second part of the mantra relates to the astronomical bodies categorized as 'seen' and 'un-seen':

**Mantra Translation**:

"*…When you think of counting bricks, think of the vast Space and those worlds out there that are observable* (धेनव: लोके = *dhenavah loke*)[1] *and non-observable* (*धेनव: अमुष्मिन् = dhenavah amushmin*)[2] *to which also these numbers apply, where you may be in rebirth* (अमुत्र = *amutra*)[3]*"* (YajurVeda, 17/2, last part of mantra).

This mantra could not have made it clearer that there are exo-planets out there in the universe where humans (life-systems) are born. For further elaboration on the translation of this part mantra this author has emphasized three crucial Vedic terms. The first superscripted term धेनव: लोके (*dhenavah loke*)[1] has two words in it wherein the first word *dhenvah* serves as a pluralized adjective to the second word *loke*. The singular *dhenavah* is *dhenu*. The root meaning of the term *dhenu* is the same as that of its other synonym**,** *गो* (= *go*, *gau* or *gavah*) which in the ancient word assemblage, Nighantu and Yask Rishi's Nirukt (2/2/1, 12/1/7) stands for an astronomical body, the Earth included. The properties of the object named *dhenu* or "*go*"

represents the property of motion, 'one that has gone far' and the one that is in orbit around its progenitor (further discussion is in Chapter 11). The term *dhenavah* stands for planets. The specific property represented by the term *dhenu* for a planet is one that is 'livable' and which 'provides nourishment' to one who lives on it. In other words it has the property of 'one that supports and is in motion or is in orbit'. The term *dhenavah* in the context of the mantra represents those planets that provide nourishment to substances and living-beings on them. Implicit in the term 'nourishment' is that the planet provides all inert substances such as water, air and matter to sustain life.

The term *lok* means 'terrestrial world where *lokas* live'. The pluralized term *lokas* mean all living-beings. Thus the term *lok* stands for '*the abode of living beings*'. In addition to the word *lok* frequently appearing in the Sanskrit Literature it is also in the active vocabulary of the present Indian society. Educated and uneducated people alike, use the compound word *prithvi-lok* where *prithvi* means the Earth. Therefore *dhenvah* the pluralizing adjective to *loke* means '*the orbiting worlds that are observable and are the support for life*'. The expression *dhenavah loke* in the terminology of modern astronomy would mean - 'on the observed exo-planets'.

The mantra not only takes us outside of our solar system but it takes us to the region of space beyond our observation. The second pair of superscripted terms धेनवः अमुष्मिन् (*dhenavah amushmin*)[2] means - '*on the orbiting worlds that exist but not seen*'. It is the term *amushmin* that puts the terrestrial bodies in the category of 'non-observable'. Even when more of the presently non-observable exo-planets become observable in time with the help of powerful telescopes, there will still be uncountable exo-planets that would remain un-observable (*amushmin*). The two Vedic categories of exo-planets, the seen (*dhenavah-lok*) and the unseen (*dhenavah-amushmin*) will continue to be the feature of the vast universe. The Vedic *rishi* did not miss out the fact that the universe is not only what one observes but it is unfathomably large with unobservable celestial objects beyond the human ability to observe.

The fact that the *rishi* of the mantra puts planets in two categories, the seen and the unseen, indicates that it is not a fleeting reference or a chance observation. To address an illuminated dot in the night-sky with the term *lok,* which by definition is like the Earth, is no ordinary observation. Most

planets of our solar system, discussed in detail in Chapter 11, are counted and named in the Vedas and the ancient Vedic Literature. So it is important to note that the *rishi* of the YajurVeda mantra (17/2) cited above did not say that "*… you may be in rebirth* (अमुत्र = *amutra*)[3]" on the planet *Mangal* (Mars) or on *Brihaspati* (Jupiter) and so on which are *dhenavah-loka*s seen in the night-sky. Obviously the *rishi* had made a reference to the seen and the unseen exo-planets capable of sustaining life.

Implicit in the YajurVeda mantra (17/2) cited above is the understanding that the emergence of life and consciousness on planets with terrestrial makeup that are capable of nourishing substances and living-beings, is a rule throughout the universe than an exception. The *rishi* certainly is not limiting the advent of life and consciousness to our Earth alone. A synonym for the Earth is *Vasudha* (*support for vasus*). The term *vasu* means "*living-being inhabitants*". Swami Dayanand Sarasvati referring to the ancient commentary book on YajurVeda (Shatpath Brahmana, 14/6/7/4) answered a question in the chapter 8 of his book Satyarth Prakash (publ. 1881) stating – "*Yes, living-beings inhabit celestial bodies throughout the universe and that is why celestial bodies acquired the name vasu (including the Earth)*". He said this over a century ago before modern astronomy discovered exo-planets.

Those emphasizing earth-centric Grand Design are to understand that the Earth according to the Vedas is not alone in the universe to sustain life. The Earth no doubt has been sustaining an unimaginably high diversity of life-forms for billions of years; however, it is not sufficient to accommodate all quanta of consciousness of the universe taking birth in all possible forms of their bodies. Those emphasizing the discovery of life on distant exo-planets light-years away from the Earth and pitching it against Grand Design hypothesis are to understand that the discovery of exo-planets and even a certainty of life on them do not prove that the advent of the universe was an accident in the gravitational field. If anything, the *discovery of a planet orbiting a star outside our own Solar System is a turning point* for all to recognize that life and therefore consciousness is also a ubiquitous property of the universe. With exo-planets supporting life, the earth-centric Grand Design believers will have to extend their Grand Design to the entire universe as it is in the Vedic perspective.

One unique feature obvious from the above Vedic reference is the 'rebirth system' followed by the quantum of consciousness, the soul.

Implicit in the rebirth system is that the quantum of consciousness called the soul is a non-perishable entity that causes life and consciousness in matter, the matter otherwise being inert. The Vedas and Vedic philosophy have expounded on the subject and have asserted that the soul is a non-perishable conscious entity. Of numerous references at hand a reference on the nature of the soul (*Atma*) from Bhagvadgita (2/20) is presented below:

> *"Neither it* (*Atma* =soul) *is born nor it ever dies. It is not that if it came once* (to take birth in a body) *it will never come back again. It is eternal, unchanging perpetual and ancient. It is not killed by killing the body, it lives on"* (Bhagvadgita, 2/20).

The emphasis in this and the *shloka* that followed (Bhagvadgita, 2/23) implies that the tools made of matter neigther can capture or destroy a soul nor can they subject it for testing and measurement. The best proof of soul's existence is that its presence in the physical body gives rise to consciousness in otherwise an inert conglomerate of limbs and organs. Under the rebirth principle, taking birth is possible on the Earth or on another planet if the planet is capable of sustaining life (YajurVeda, 17/2). Therefore, a sage may have experienced being born on another planet before formulating the above mantra. In the long history of the universe we all may have been born on other planets but cannot recall owing to our limited spiritual development in personal consciousness unlike the self-realization that a sage might have had. This is another explanation from the Vedic perspective for a belief in the existence of धेनव: लोके (*dhenavah loke*)[1] and *धेनव: अमुष्मिन्* (*dhenavah amushmin*) [2].

The Vedic definition of the quantized consciousness of the second-kind called *Atma-tatva* (individual souls) and the conterminous consciousness of the first-kind the supreme, omnipresent, unitary spirit, named Brahmn in the Vedas, God in English, are discussed in Chapter 5. Under the Vedic principle, all souls of the universe are ubiquitously present (Saankhya, 1/114; Vaisheshik, 3/2/21) through the universe and not limited to the Earth only.

There is hardly any difference in the Vedic principle of ubiquity of life in the universe and the thought contained in the statement of one of the

discoverers of the new exo-planet Gliese 581g orbiting around the star Gliese 581, two hundred trillion kilometers away in the constellation of Libra (Vishakha in Vedic astronomy). Announcing its discovery on September 29, 2010, Steven Vogt, a professor of Astronomy and Astrophysics at the University of California at Santa Cruz stated:

> "*Personally, given ubiquity and propensity of life to flourish wherever it can, I would say, my own personal feeling is that the chances of life on this planet* (Gliese 581g) *are 100 percent. I have almost no doubt about it*."

Whether a conscious-being soul creates life as stated in Vedic Philosophy or life is a onetime accident in the chemistry of the planet before the hypothetical evolution takes over, as assumed in modern biology, the *ubiquity and propensity of life* is turning out to be an increasingly accepted fact regarding the universe. The possibility of life on exo-planets and life's ubiquity through the universe encourages one to think again about 'life on Earth began as an accident'. If life were an accident on Earth, it has to be an accident on all those exo-planets that support life. Then, it is hardly an accident and rather it is a phenomenon with a root-cause. The theory suggesting the accidental start of life on Earth would therefore remain to be an un-provable hypothesis. This is the real turning point. As this author generalized above using a mantra reference and as stated by Professor Steven Vogt and subsequently by other astronomers, life seems to be sustained throughout the universe. Then the *discovery of a planet orbiting a star outside our own Solar System* should have been *a turning point*. Life being ubiquitous in the universe suggests that the advent of life on Earth is not an accident. This generates the possibility of the forces and fields of differing nature yet to be discovered that could have been the participants in the process of the creation of the universe.

For a truth-seeker physicist, searching for answers to questions regarding our universe, the concepts of the conterminous consciousness (the first-kind, Supreme Consciousness), the quantized consciousness (the second-kind, souls), the karma principle leading to the birth and rebirth of a soul on this planet and its instantaneous transmigration to other planets, ought to all remain on the table for discussion and study.

The Vedic explanation for how the *rishis* arrived at such mind-boggling deductions relates to both, physics and philosophy, to be discussed

in another book. Limiting this author's suggestions to the present reference frame of physics, the deductions of the ancient *rishis* could have had a theoretical basis if not the astronomical. But why would a *rishi* teach about large numbers first up to $10^{18}$ then talk about the universe that is observable to have धेनव: लोके (*dhenavah loke*)[1] and the universe that he was not able to observe but knew it was there to have धेनव: *अमुष्मिन्* (*dhenavah amushmin*)[2] the planets with life on them that were non-observable? This mystery remains!

The author concludes this section with one more reference on this topic. Rishi Etareya stated in the book of Etareya Brahamana (iii, 4, 6, 44) that the person (person's soul) who understands the physics knowledge about the Sun acquires coexistence with the Sun and "…*is born* (in next birth) *on planets with brilliance*".

## The Vedic "*Kaaran-Kaarya*": "Cause-Effect" Principle

The cause-effect principle and its application has been discussed a number of times in the earlier pages. Under this section the Vedic perspective of 'cause-effect' is presented with formal definitions of its components and its applicability in both realms – material (physical) and spiritual (metaphysical). The consciousness in Vedic philosophy is seen in a realm separate from the material realm. The two realms make the Vedic cause-effect (*kaaran-kaarya*) principle a universal principle. As mentioned before, all physics laws governing the matter of the universe come under Creator's laws addressed as *satyam* and all laws governing the spiritual realm come under Creator's *ritam* laws (RigVeda, 10/190/1). As an example, the law of gravity is under *satyam* and the law of rebirth, that determines spiritual evolution of a quantum of consciousness (soul) leading to the consequential rebirth comes under Creator's *ritam* law. Because they are Creator's laws to govern the universe in both realms they are invariant. The gravity cannot be switched off when one is falling under gravity and bad karma cannot go unpunished.

Vedas are inundated with mantras that explicitly point to the *kaaran-kaarya* (cause-effect) in differing situations in physical and spiritual

realms. Relevant parts of some mantras are listed below:

> "*… those scholarly who understand with clarity the causal-Nature (matter) coming into the creation-phase giving birth to all substances and reversing into the causal-state dissolving all substances of the universe, cognize both* (**सह वेद उभयम्** = *saha-ved-ubhayam*) *simultaneously…*" YajurVeda (40/11).

The term **उभयम्** (*ubhayam*) means 'both' and stands for the *kaaran* and the *kaarya* - the 'cause and effect'. The RigVeda further makes it explicit in the following mantras:

"*…the Nature (universe) in its state of existence was hidden in its diminutive causal state of matter…*" RigVeda (10/129/3).

*"... Rishis in their contemplation comprehend cognitively the binding principle of causal relationship that the cause for Sata the definable (state of matter) lies in the Asata the indefinable (state of matter)."* RigVeda (10/129/4).

*"…fundamental seeds of matter are the cause for the great celestial objects. In this process, the Svadha* (Nature) *is subordinate* (material-cause) *and the Creator's inspiration is paramount* (efficient-cause)*"*. RigVeda (10/129/5).

The three main 'causes' in the Vedic philosophy are formally defined in the following with their equivalent English names. They are similar to the components of the 'causes' in the Western philosophy.

***Nimitta-kaaran* : Efficient-Cause**

The *Nimitta-kaaran* in Western terminology is equivalent to the efficient-cause or the first-cause or the prime-cause. The implied meaning of the word *nimitta* includes '*a cause with motive to create a kaarya*' where *kaarya* means the created '*action*' which is the 'effect'. Since the *Nimitta-kaaran* does not consume itself in creating the resulting effect, this cause is also addressed as the associative-cause.

***Upaadaan-kaaran* : Material-Cause**

The *upaadaan-kaaran* is the same as the material-cause in Western philosophy. The other Vedic term for this cause is *samvayi-kaaran* (intimate-cause). The implication here is that whether the resulting 'effect' is a substance, an action or a property, the *upaadaan-kaaran* (or *samvayi-kaaran*) is matter and its forms, whatever the resulting form of the 'effect' may be.

***Saadhaaran-kaaran* : Ordinary-Cause**

In some contexts this cause is also addressed as the associative-cause because this cause is not consumed in creating the effect. It does not initiate the action (cause) but is needed to enable the action which causes the effect. The *Saadhaaran-kaaran* could be a substance or an entity such as the Time-entity or the Space-entity that is neither the material-cause nor the efficient-cause. Between the efficient-cause and the ordinary-cause the efficient-cause is the initiator of the effect which may necessitate association of the ordinary-cause. The *saadhaaran-kaaran* (ordinary-cause) is different from the material-cause but owing to its associative nature it is sometimes viewed as the efficient-cause.

The cause-and-effect is present in all processes in all directions of the universe. From the onset of the creation of the universe, a cause leads to an effect and what is produced in the effect serves as the cause for the next state of matter, thus setting a chain of cause and effect. Cause-effect is a pre-existing rule in Nature and we see it all around us. Contrasting this, there is no specific logic that would suggest that the universe, which is the action (effect) of Nature, came into being without its cause. Also the observed fact on the 'arrow of time' is that the cause precedes the effect and observing the chain of cause-effect leads to increased knowledge about Nature.

If $2x10^{30}$ kg of matter was not available about 4.6 BY ago at a given time and locale of the universe our solar system would not have come into existence. Therefore, this matter was the *upaadaan-kaaran* (material-cause) for the solar system. Of course, the preexistence of this mass alone is not sufficient to create the solar system and the orderly shape that it is in, with one of its planets called Earth in such a remarkable balance that intellectual beings and the rest of the complex living systems could exist on it. Simultaneously with the material-cause existed other associative-causes like – gravitation as the inherent property of matter, the solar system's position

in our galaxy with its initial linear and angular motion and so on and so forth. Therefore, in Nature we always see something preexisted to serve as its material-cause. When this observation is extended to the actions of the living-beings one finds that the living-being serves as the *nimitta-kaaran* (efficient-cause), at a smaller scale though, to create new things (the effect). The initiative in the case of a living-being is his own and he draws the matter for the material cause from Nature. Now, to gain a bit more insight into how the Vedic *rishis* used the subtle principle of cause-and-effect to gain knowledge about the creation, let us invoke an example from the distant past of the Vedic Civilzation.

The *kaaran-kaarya* (cause-effect) discussion is by no means a recent revival in Hindu Philosophy (the ancient name being Vedic Philosophy). The process of the creation of the universe in the Vedic Philosophy has always been thought in terms of cause-and-effect. The Veda has even assigned a Sanskrit term *maatali* for the *rishi* with specific knowledge of creation, space, time and the cosmos. Simply put, a *maatali* is a cosmologist. In the distant past of India was a Vedic *maatali,* Rishi Shvetashvatar, the author of the Shvetashvar Upanishad. His disciples while putting together a list of entities enabling the creation of the universe invoked the subject of cosmology and asked their guru Rishi Shvetashvatar - which single entity is the most important in the process of the creation of this universe?

**काल: स्वभावो नियतिर्यदृच्छा भूतानि योनि: पुरुष इति चिन्त्यम् ।**
(Shvetashvar Upanishad, 1/2)

**Transliteration:** "*Kaalah swabhaavo niyatiryadrichchhaa bhutaani yonih purush iti chintyam*"

**Sutra Translation**

*"It is our thought provoking curiosity as to which among: kaalaha* (Time), *svabhaava* (self-creation), *niyati* (preset rules of Nature or pre-existing order in Nature), *yadrichhaa* (to manifest by accident or by chance), *bhootaani* (classes of matter), *yoni* (Nature) *and Purush* (the Creator), *is uniquely important for the creation of the universe?"* (Shvetashvar Upanishad, 1/2)

Even though this question, posed by the students of Rishi Shvetashvatar, belongs to the far antiquity of the Vedic civilization, its essence is as fresh and as scientific as the questions posed in modern science and philosophy. The list in this question is inclusive of subjects and entities that modern science deals with and those discussed in modern philosophy. Whether a follower of modern science or philosophy agrees or not with Shvetashvatar's answer is altogether a different matter, the comprehensive character of this question is certainly a rarity in modern times.

Even though both, science and philosophy, relate to all that is in the universe, the apparent disconnect between modern science and modern philosophy keeps the two in different compartments. For example in this Upanishad statement, the term *niyati*, the preset rules of Nature or the pre-existing order in Nature, is well understood by the modern science and it has successfully discovered those rules through theory and experiment. The modern science has also learnt that these invariant rules of Nature govern the matter of the universe from the time it was created. However, the modern science and modern philosophy work independently; with the exception of the Natural Philosophy which would probably repeat what modern science has hypothesized and discovered. One connection between the science and philosophy is through the Anthropic Principle in cosmology where the critical and 'just right' values of Nature's laws and constants are thought to be a possible cause for the advent of living-beings on Earth. The cosmologists do not like to think of this as a pre-ordained rule of creation and therefore explain away the Anthropic Principle, with a mathematical proof without invoking a physics proof. This mathematical proof is the Multi-universe theory with the underlying argument that our universe is not special; it is just one of the $10^{500}$ possible universes out there.

Answering the question posed by his disciples, guru Shvetashvatar imparted in-depth knowledge to his students and concluded by answering that among all the possible causal entities for the creation of the universe, the uniquely important cause is the *nimitta-kaaran* (efficient-cause) and this *nimitta-kaaran* was the *Purush*, the unitary all-pervading conscious Spirit, popularly addressed in the Sanskrit Literature as the *Brahmn*. The word *purush* means '*the one pervading all*' and is used for the Creator of the universe. In the context of the creation of the universe the efficient and material causes (Creator, Nature) appear as a duo throughout the Vedic

literature– *Purush-Prakriti*, *Brahmn-Svadha*, *Paramatma-Prakriti* and so on.

From the above statement of the Upanishad it would seem that there are 7 causes listed by the students of Shvetashvatar where *Kaalah* (Time-entity), an important participant in the creation of the universe serving as the *saadhaaran-kaaran* (ordinary-cause), is included but another item of great importance, the Space-entity, was excluded or missing. In fact the Space-entity is included in the fifth term *bhutaani* and therefore there are a total of 11 items in the set presented by the Upanishad statement. In the '*vibhakti*' rule of Sanskrit grammar the singular term *bhuta* changes to *bhutau* in double-plural and it changes to *bhutaani* in plural (more than two) as in the Upanishad statement. The term *bhutaani* has five different items in it. The general term *bhuta* stands for matter. The plural usage of it in the term *bhutani* represents the five classes of elements of Vedic Philosophy, the *panch-maha-bhootas* (five-major-elements), which were briefly discussed earlier in this chapter contrasting with Aristotle's philosophy having only four elements. The first of the five *bhutani* of the Vedic Philosophy is the *Aakaash* (Space); not included by Aristotle in his philosophy. They are part of the students' list because the existence of life is not possible in the absence of even one of the five *maha-bhootas*.

It becomes obvious from the question of Shvetashvatar's students that the discussion on philosophy, cause-effect and recognition of the entities of Nature, which is the creation itself, had gone on before the period of the Shvetashvar Upanishad. This is why the students in the statement of Shvetashvar Upanishad came up with the list of 11 important entities that are observed to be the causes in the process of creation. The concept of Time (first item in students' list) and Space (part of the fifth item in their list) as entities playing a role in the creation and sustenance of the universe are well established in the ancient Vedic science/philosophy. Notice that *Purush* the Creator and *Yoni* the Nature appearing in the same list as two distinct entities is indicative of the fact that in the Vedic philosophy they certainly are two different entities. This is unlike in pantheism where everything is Nature (matter) or in Advaita Vedanta Philosophy of non-duality propounded by Aadi Shankaracharya where everything is *Purush* the Creator. The inert Nature for the Vedic Philosophy remains as the material-cause (*upaadaan-kaaran*) and the conscious-being Creator as the efficient-cause (*nimitta-kaaran*).

Similar philosophical thoughts are expressed throughout the continuity of the Vedic Philosophy. Someone posed a question to the great Vedic philosopher and author of the 19th century, Swami Dayanand Sarasvati, whom this author has cited a number of times - '*How many types of causes are there for the creation of the universe*?' Based on the Darshans, Upanishads and Smritis he elaborated the answer in his book Satyarth Prakash. A translation of his answer from the Hindi language to English is presented below. The bracketed items are this author's insertions:

> *"Three: one nimitta, second upaadaan and third saadhaaran* (efficient, material and ordinary). *Something will come into being due to the nimitta kaaran* (efficient-cause) *and nothing will come into being without it. It* (efficient-cause) *itself does not come into being but transforms other. The second upaadaan* (material-cause) *is the one without which nothing can come into being, a change in it is a change of its state to generate another - it degenerates into another. The third saadhaaran-kaaran* (general or ordinary cause) *is saadhaaran-nimitta-karan* ('ordinary-efficient-cause') *that coexists in association with the primary-efficient-cause. Of the two efficient-causes, one 'primary efficient' is the Paramatma* (the Creator of the universe) *who creates the universe out of universe's material-cause, sustains it, dissolves it and keeps it in order.*
>
> *The other cause* (ordinary-efficient-cause) *takes the created substances from Creator's universe and variously transforms them for its utilization, is the conscious-being souls. Prakriti* (Nature), *the material-cause is made up of atomic matter* (fundamental particles)*, is known as the primordial building material for the construction of the universe, is inanimate and inert and is neither capable of transforming itself into something specific nor is it capable of demolishing itself* (from Satyarth Prakash, Ch. 8, 1881 CE)."

It is obvious from the above quotation that the cause-effect and differentiation between the specific causes and effects have been a central theme of the Vedic Philosophy. In another context when a scholarly person expressed doubt on the harmony among all six Vedic Darshans (Philosophies) on the cause of creation, this Vedic scholar par excellence, Swami Dayanand Sarasvati, summarized it in the book of Satyarth Prakash,

that all six Darshans complemented each other on the question of the creation principle of the universe. He wrote:

> "*In Meemansa* (Jaimini Rishi's Meemansa Darshan) - *there is no 'effect' in the universe without desired action; in Vaisheshik* (Kanaad Rishi's Vaisheshik Darshan) - *nothing is created without time*; *in Nyaaya* (Gautam Rishi's Nyaya Darshan) - *nothing could come into being without its material cause*; *in Yog Darshan* (Patanjali Rishi's Yoga Darshan) - *nothing can happen without knowledge, wisdom and thought*; *in Saankhya* (Kapil Rishi's Saankhya Darshan) - *creation is not possible without togetherness of causal entities*; *and in Vedanta* (Vedvyas Rishi's Vedanta Darshan, same as the Brahm Sutra) - *nothing can be created if the Creator does not create it"*.

It becomes abundantly clear from Swami Dayanand Sarasvati's answer that the subject of the creation of the universe in Vedic thought is indigenous to India. Also the Veda mantras are the basis for the philosophical principles in all six Darshans, a fact made clear by the *sutras* or from the direct reference of Veda cited by the *rishi* in his Darshan. The six Darshan treatises written in different time epochs prior to Mahabharata War (ended in 3140 BCE), in six differing realms of philosophy, by six different *rishis* have also served as a methodology for the dissemination of Vedic knowledge. The Vedic knowledge in the form of mantras, the statements of Brahmanas, the *sutras* of Darshans and *shlokas* of Smritis and Upanishads was handed down directly to deserving minds and was presented to the common people at a simpler level with examples and similes. The example of the 'pot-maker and the earthen-pot' is often cited in the interpretive commentaries on the Vedas and Darshans. The example of the 'pot-maker' to differentiate between the causes perhaps is as old as the Darshans and Upanishads. Let us for a moment indulge in this ancient example.

When an earthen-pot is created from the clay (sand) drawn from the earth, a human being pot-maker is the *nimitta-kaaran* (efficient-cause or first-cause), the clay is the *upaadaan-kaaran* (material-cause) and the implements like *chaak, dand* (spinning-wheel, stick), water, place (space), time and several other factors that enable the creation of a pot are the *saadhaaran-kaaran* (ordinary-cause or associative-cause).

A pot-maker does not make pots without purpose. If pots had no utility the pot-maker would not have the desire to make pots. He makes pots to fulfill the need of the others. The Creator creates the universe for all souls to enjoy the creation and do karma. Although the villagers are not involved in pot-maker's preparation of the raw material and pot-creation, his association with the villagers is the main cause for him to make pots. Therefore while the pot-maker is the *nimitta-kaaran* (efficient-cause) in this scenario, the people of the village serve as the *saadhaaran-kaaran* (ordinary-cause). The pot-maker's example delineates a glimpse into the simplicity of explanation in the ancient Vedic Civilization.

A pot is created 'because' of the pot-maker's 'desire to create' and the villagers' 'desire' to be fulfilled. A physicist could setup a set of equations to model the pot-maker's process but the physicist would not know how to work-in the parameter named 'desire' in his complex set of equations. Desire is a metaphysical or a spiritual entity present in conscious-beings. It is absent in clay molecules, because, if desire existed in clay molecules, they could assemble themselves into a pot! With reference to the cause-and-effect Swami Dayanand Sarasvati also stated in Satyarth Prakash,

> "*…the cause is subtler than the effect and in the sequence of creation the preceding entity is the cause of the next"*.

# The Karma Principle

Thw Karma Principle is a vast subject to be taken up in a separate book. Contextually this author presents here a glimpse into the subject.

The cause-effect in the Vedic perspective pervades through both realms – the consciousness and the physical. The quantum of consciousness (soul) cannot carry out any action without a physical body. All 'actions' (karma) performed by a physical body are inspired by the soul in that body. Therefore, the soul is responsible for all karma, good or bad. Good karma raises the level of spiritual evolution of the soul and a bad karma brings it down. The soul has the freedom of action (karma) but has no freedom to reward itself for good karma or punish itself for bad karma. To have universality and uniformity in accounting for the consequence of a karma the Vedic Philosophy has put it under the *ritam* law of the Creator. This basically is the karma principle of the Vedas. Let us now consider some logistics of the Karma Principle.

The cause in a physical cause-effect chain is consumed in creating the effect. In a metaphysical situation (related to consciousness) the cause may continue to create effects without getting consumed. A conscious-being may generate a thought (cause) in his mind. A thought is a non-material and non-substantive action. However, the thought could be implemented using the physical body to create a tangible object (effect). The conscious-being has the 'free-will' to repeat the process without apparent consumption of the thought producing machine, the mind. Therefore the cause-effect has to be seen differently in the physical and the spiritual realms.

In the case of an aggressor the mind of the aggressor is the cause and the assault by his physical body is the effect. This kind of karma and its consequence are settled by the laws of the society by putting the aggressor behind bars. Thus the physical body of the aggressor is getting the punishment and not the thought producing system, the mind of the aggressor. The thought creation is at a metaphysical level and the implementation of thought is at a physical level. Therefore for complete justice, the punishment ought to be levied at both - the metaphysical and the physical levels. It is straightforward to determine and apply the punishment at a physical level but it is difficult to quantify and apply the punishment at

the metaphysical level. So, does the aggressor get away with only the physical punishment and the victim is left to suffer an irreversible loss?

Also if the aggressor is not caught in the act of committing the crime, the societal system is not able to levy any punishments on him. If the aggressor gets away unpunished or bribes his way out of a punishment the people call it as society's unfair system and a theist may even call it the unfair system of God. For a truly just system the aggressor may escape society's law but he should not be able to escape the *ritam* law of the Creator under which the spiritual level (soul's evolution) of the aggressor is automatically brought down (punished). The aggressor may face the consequence of this change when his karma catches up with him in this life or when he takes a new birth.

All quanta of consciousness in the universe come under the law of karma and the balance between the good karma and bad karma determines the level of evolution of a person's consciousness. Depending on the level of bad karma the consequence could be the next birth as a low level life form. Because the cause-effect in the Vedic Philosophy is seen encompassing the physical as well as the spiritual aspects of the universe, the law of karma is accepted as a just and universal principle. The cause-effect in the Vedic Philosophy is also expressed as the *karma-phal* (action-result) principle. This preset law of creation displays the differences between different living-beings. The level of consciousness in a living-being relates to his/her accumulated karma (actions). Because the law of karma applies uniformly to all and a conscious-being owing to free-will has control on his own karma but has no control on the *karma-phal* (result), the law of karma is considered to be just and fair.

The karma balance-sheet according to the Vedic Philosophy is part of the person's consciousness which the person cannot shake off. Also, the person has no freedom and control to delete unwanted items from the karma balance-sheet! The record of his good and bad karma remains with his consciousness and is a part of that living-being's nature. The cause-effect principle in the physical realm and the karma-*phal* (karma-consequence) principle in the spiritual realm are an integral part of the Vedic Philosophy because without it one would have difficulty explaining why conscious-beings have different starts in this life, right from birth, even before they have had a chance to do good or bad karma. A full exposé answering all

questions pertaining to the karma principle and the rebirth system is beyond the scope of this book.

## About the Vedas and the Mantra Translation

The Chapter 4 entitled "A Brief Review of Ancient Vedic Literature – the Source of References on Cosmology" presents a brief discussion on the vast Vedic Literature and its branches. The term '*veda'* means the '*revelation of knowledge*', When the term *veda* is used as a noun it means the '*book of knowledge*', which includes the four Vedas (Rik, Yaju, Saam, Atharva) without any label of a prophet attached to it. The term is not limited to representing knowledge in a specific area but implicit in it is knowledge pertaining to all realms of creation; animate and inanimate. The general Sanskrit term for 'knowledge' is *gjyaan* and the term for specific knowledge is *vigjyaan*. It is the prefix *vi* to *gjyaan* that changes the meaning from 'knowledge' to the 'specific knowledge' or to the 'special knowledge'. The term *vigjyaan* in common usage of the word means 'science' because it reveals specific knowledge of a given phenomenon in a given subject. One finds in the Vedas and the subsequent books on the Vedic philosophy many adjectives for knowledge in specific realms. A *sutra* from the ancient Vedic Philosophy expressed thus – इति ह विज्ञायते (*iti hh vigjayate*) meaning *'this is deduced from scientific knowledge'*, where the scientific knowledge in Vedic terminology is defined to be the knowledge acquired by practical means and confirmation. Therefore, examples of Veda mantra references, with added details deferred to forthcoming chapters, are worth examining from the science perspective.

The two basic states of matter (*Sata* and *Asata*), the Vedic concepts of Space and Time, the birth of the universe with a bang, the Earth being round, having the property of gravitation, being in space and revolving repeatedly around the Sun and so on are just a few examples presented in this introductory chapter that are topics of modern science as well. This author having a background in physics has found the Vedic knowledge fascinating from the scientific perspective and therefore the effort in writing this book.

The knowledge content in a Veda mantra is presented in Sanskrit terminology in poetic expression with specific meters. The Sanskrit script is also known as the *Devnagari*-script. In the earlier times the Vedas were learnt by heart and hand-written in indelible black ink, on *bhoj-patra*, the thin bark of the Himalayan birch tree. The universality of thought is the unique feature of the mantras and they cover a wide range of subjects. The four Vedas together contain a total of 20,416 mantras in the realms of the physical and the spiritual creation, including cosmology, the subject of this book. The term "Vedic Cosmology" frequently used in this book represents cosmological thoughts and cosmological principles contained in the mantras as well as the cosmology scenario developed in this book by this author based on the Veda mantra references.

This book also includes contextual general science thoughts and subjects related to the physical phenomenon in the universe. The development of the Vedic Cosmology Scenario by this author (Chapters 6 through 10 in Volume 2) is based on the relevant mantras from the Vedas and the ancient commentary books on the Vedas, supplemented by the references from the books on Vedic Philosophy. The post-Veda ancient books, together, are addressed as the Vedic Literature.

This author takes several steps for the composite mantra translation from the Vedic Sanskrit into English. First the mantra is presented in *Devnaagri* (Sanskrit script) followed by the transliteration of the mantra. Then all euphonic conjugations between the words are delineated and individual words are listed with their English meaning. The Sanskrit language being rich in science terminology, a Sanskrit term having multiple meanings is translated using English terms that convey the closest representative meaning in the context of the mantra. For the sake of brevity at times the direct English translation of a mantra without a detailed translation of the Sanskrit terms is presented. The translation of each term from Sanskrit to English is primarily based on the interpretive translation of the RigVeda and the YajurVeda by Swami Dayanand Sarasvati (1825-1883 CE), wherein he has provided term-by-term translations in the Hindi language. From his Hindi translations this author has synthesized the English translation. The English translation of mantras from the AtharvaVeda and the SaamVeda are based on the Hindi translations of well-known Sanskrit grammarians and Vedic scholars commissioned by the Arya Pratinidhi Sabha, a world body of all Arya Samajs.

An Arya Samaj is a society with the aim of promoting the Vedas, the Vedic Literature and the Vedic Culture. The first Arya Samaj was initiated by Swami Dayanand Sarasvati in Bombay (Mumbai) in 1875. For the word analysis and the mantra translation this author has frequently referred to the Hindi interpretation of Nirukta by Pt. Sitaram Shastri (Parimal Publications, Delhi, 2005) and Nighantu the ancient word assemblage for specific Vedic terms. Whenever necessary the author has used two Sanskrit-English dictionaries: "The Student's Sanskrit-English Dictionary" by V. S. Apte (publ. New Bharatiya Book Corporation (India) and the "Sanskrit-English Dictionary" by Monier-Williams (publ. Clarendon Press, 1899).

The very first Veda, the book of RigVeda alone contains a total of 10,521 mantras in 1,028 *suktas* using about 153,792 words. A *sukta* represents a collection of mantras specific to a *devata* (subject). Therefore, a *sukta* is a section within a chapter which the Indologists termed as a 'hymn'. Sanskrit, the language of the Vedas, is rich in grammar and vocabulary and is universally accepted as a highly developed ancient language. The richness of a language can be judged by the dictionary of that language. The English language, enriched with words from Latin, Greek and other European languages has an impressive vocabulary of about 86,000 words. It is well-developed to express and explain complex thoughts and phenomena in most subjects, including physics and cosmology.

When M. Monier-Williams (1819-1899) published his Sanskrit-English dictionary in 1899 it had 180,000 Sanskrit words and by no means was it a complete dictionary.

The Sanskrit language, according to an authority on the Vedas, with a title of Vedalankaar, Professor Subhash Taneja, Head of the Sanskrit Department, Rajasthan University, India, has over 3,683,800,000 words in its dictionary; not a single word borrowed from any other language. His reference is the well-known ancient Sanskrit dictionary called "Shabd Kalpdrum" and the number of words mentioned above is based on the computer count of the words in that dictionary. This dictionary is available in fine print in five thick volumes in the page size of one foot by one and a half feet. Professor Taneja, however, insists that this computer count is an under-estimate. Such immense vocabulary containing nearly four billion words can only stream out of an extraordinary language that is predisposed with the scientific methodology for word-creation and word usage with a seamless grammar developed by extraordinary people of an extraordinary

culture and civilization. The linguists know that Sanskrit is an extraordinary language.

Mistranslations of the mantras by ill-prepared Sanskritists and Indologists of the nineteenth century have caused extensive damage, misconceptions and misunderstandings about the Vedas. Some Western scholars of the past few centuries learned Sanskrit and enthusiastically translated Veda mantras into English and other languages without learning the proper rules of Sanskrit grammar and its science of etymology that is prescribed specifically to understand, interpret and translate Veda mantras. Their ignorance led to generating and disseminating prejudice and misconceptions regarding the Vedas. Professor Max Muller (1823-1900 CE) of Oxford University, England, translated the RigVeda shabbily with weird meanings of Vedic terms.

Based on mantra references these misconceptions are dealt with in Chapters 3 and 4 emphasizing that the Vedas have no rituals, no multiple gods, no human history, no mythical characters and that the Vedic poetry is unique, complex and not easy to emulate. Vedas offer amazing science thought for understanding a complex subject like cosmology. The post-Veda literature (Sutras, Upanishads, Smritis, Brahmanas and so on) is the result of the in-depth study of the Vedas by the ancient *rishis*.

The mantra formulations in the Vedas are highly organized in chapters and sections with accreditation to the *rishi* responsible for the formulation. Large number of references from the Vedas and Vedic Literature are presented throughout this book. It will become obvious that the *rishis* have dealt with the subjects of cosmology, astronomy, general science and philosophy with brevity and methodically.

A natural question, the answer to which is still being sought by the modern scholars of Indology is - how old are the Vedas? Many among the modern scholars have guessed erroneously but no one has convincingly determined the period for the advent of the Vedas. A reasonable chronological hierarchy of literary works in Vedic Literature, beginning with the Vedas in the unknown ancient times, till the book of Mahabharata and Bhagvadgita (3140 BCE) is presented in Chapter 4. In Chapter 3 entitled- “Historicity of Vedic References: The References on Cosmology Precede 5000 years”, the author initiates a hypothesis and proves that the Vedas and all the references from Vedic Philosophy and literature used in this book, for building the story of the Vedic Cosmology, are anterior to an

important time-milestone in human history at February 18, 3102 BCE. As mentioned earlier, this date is the astronomical onset of the *Kali-yuga*, the present epoch of the *Srishti*-calendar of the Aryans, discussed further in Chapters 3 and 5. Therefore, the Vedic references being ancient in the real sense of ancientness, Vedic thought had not come under the influence of cultures and writings of civilizations exterior to India and has certainly not been affected by modern scientific development which is relatively very recent.

Based on new genetic research on Indian population, carried out under the national genome projects and archeological finds it is established in Chapter 3 that the Aryan Invasion Theory and Aryan Hypothesis concocted in the late 19$^{th}$ century by Max Muller et al. was a hoax. The detailed genetic research on the DNA of the Indian populace with state-of-the-art scientific tools under a multinational research collaboration yielded the fact that the Aryans of India are indigenous to India (see Sahoo et al. in Proceedings of the National Academy of Sciences of the Unites States of America, Vol. 103, no. 4, 843-848, January 24, 2006 and Sengupta et al. in The American Journal of Human Genetics, Vol. 78, 202-221, February, 2006).

To be specific, these papers concluded, along with many more that followed, that the age of the accumulated microsatellite variation (of DNA) in the majority of Indian haplogroups exceeds 10,000-15,000 years leading to the fact that the Indians have been on the Indian sub-continent indigenously for an extremely long time. In terms of geological epochs, the Indians in India have shaped the distinctive South Asian Y-chromosome (paternal) landscape at least since the pre-Holocene and Holocene-era exceeding 10,000 - 15,000 years going back into the Pleistocene epoch extending from 12,000 years to 2.5 million years. Therefore, the Indo-European expansion under the Aryan Invasion Theory, hypothesized earlier by Max Muller et al. is proven wrong. The genetic research has indisputably validated the antiquity of the indigenous people of India and therefore their corresponding ancient Aryan culture which includes the Sanskrit Literature and the four Vedas.

# Age of the Universe

Hawking in his earlier book remarked that - "*According to a number of early cosmologies and the Jewish/Christian/Muslim tradition, the universe started at a finite, and not very distant, time in the past*". This finite time was about 5,000 to 6,000 BCE. This is negligible compared to 13.8 BY estimated in contemporary astronomy. To match this big number, the numbers provided in the scriptures were re-interpreted by saying that God's one day was much bigger than Earth's.

Hawking's statement does not include the Vedic Creation Principle, now discussed by this author in detail in Chapters 6 through 11, Volume 2). The universe according to the Vedic cosmology principle did start in a distant past, about 2 billion years ago. This number assigned to the age of the universe by the Veda is closest to the estimate by contemporary astronomy and is in the same order of magnitude (in billions). A remarkable fact about this number is that it was assigned to the universe by the Veda in the distant past of the historical milestone at 3140 BCE. It is an extraordinary ancient result.

Some of the first estimates of the age of the world in the modern era came from counting Biblical genealogies. John Lightfoot in 1642 CE estimated that the world was created 4,940 years ago and according to James Ussher's estimate in 1650 CE it was created 5,654 years ago. Then the scientific methodology for age estimate of the Earth began. Based on the cooling rate of the Earth, Buffon in 1760 CE estimated Earth's age as 75,000 years. From 1831 CE to 1890 the scientific methods yielded the age in million years. In 1907 to 1947 the age of the Earth was estimated to be about 2 billion years. As this author understands it the Vedic age of the universe and the Earth are treated near simultaneous. Thus the Vedic estimate of the creation about 2 BY was on par with the modern era scientific estimates. There are no conversion factors between the Creator's and Earth's year because the Vedic estimate is based on astronomy and the Aryans have been tracking it since an unknown period.

The definition of a day or a year is based on a given frame of reference. The above numbers on the age of the universe are in Earth's reference frame. The one year of Jupiter (Jupiter's one revolution around

the Sun) for example is 12 years of the Earth. Likewise the 'cosmic year of the Sun' in which the Sun revolves once around the centre of the Milky Way Galaxy, carrying the entire solar system, is 225 million Earth-years. Therefore, God's one day could be defined in Earth's reference frame with a multiplier and a rationale attached to it.

For helping mathematical manipulation of cumbersome numbers, deriving a conversion factor is a brilliant invention of the human mind. The practice of using conversion factors is not a new phenomenon in human history. The science of determining a conversion factor in Vedic tradition is extremely old. The examples from Manusmriti not only exhibit the science of the conversion factor, but go beyond a simple mathematical multiplier, delineating clearly Manu's grasp of physics/astronomy as well as of global geography.

Manu realized that the definition of a day on the Earth itself is not absolute. A day (sunlight period) and a night (dark period) form Manu's *aho-ratra*, which is a 'day' in the present society even though it includes a night as well. A day at the Equator (day + night) is 24 hours. At the geographic pole there is a bright and a dark period, each six months long. Therefore, one day at the Pole is one year at the Equator. To differentiate a day at the pole and a day at the equator, Manu picked the terminology from the Veda and addressed the polar-day (one year of Earth) to be a *deva-day* or a *devic-day*. Several *shloka* couplets (Manusmriti, 1/65, 1/67) define the conversion factors, stating as "*One year of humans is one devic day-night…*" (at the pole). It points to the fact that Manu knew the difference in geography between the pole and the equator. Introducing about three dozen terms for the time units, Manu has provided the conversion factors for the time starting from 4.32 BY down to the time-unit of *nimesh*, where one *nimesh* is exactly 8/45 second (177.778 milliseconds). This is discussed in detail in Chapter 5 under the sub-heading of 'Measure of Time-entity'. The conversion factors are presented in Tables 5.2 through 5.5. The time measurement of *nimesh* is also discussed in Chapter 5 under the sub-title as "The Case of Nimesh: A Mind-Boggling Situation". The accuracy in extracting it from the human physiology, the blink-time of the normal human eye-lid, is unbelievably high. It is this small unit of time that was in practice in the Vedic society and continued to be a unit in practical Vedic astronomy for accurate ascertainment of the position of star in a constellation.

Even if there is a mismatch between the age assignment in modern astronomy and the Vedic creation age, the Vedic system has worked within a preset premise. This premise, to be discussed later, has the astronomical basis. According to the calculation method used for the Vedic age of the universe (Earth), which is also the method that enables the calculations of important dates in the history of the Vedic civilization, this author estimates the onset of the Vedic clock for the present creation to be 1,972,949,118 years ago (about 2 BY) in 2018 CE. In fact, by studying the well maintained practical luni-solar calendar of the Aryans, the *Srishti-samvat*, one can even work out the age of the creation, right to the day, hour and minutes. For some unknown astronomical reasons, the Aryans introduced a long-term sub-harmonic within the same Aryan calendar with the frequency of 306.72 MY that they called *manvantar* and gave 14 different names to them covering the entire creation period of 4.32 BY (see Table 5.4 in the Chapter 5). The *manvantar* relates to the periodic Big Flood which destroys most of the life and civilization on Earth, rejuvenating the creation again with a new beginning and new order. The last Big Flood was the 6$^{th}$ since the creation. More discussion on this is in Chapter 5.

The references pertaining to the numerous physical principles show that it is not just a chance factor that happens to assign 4.32 BY for the total age of the creation-epoch. The present section is concluded by presenting one of the several mantras that provide quantitative information on events and the early history of the universe. This RigVeda mantra provides an estimate of the period that separated the first appearance of vegetation and humans on the Earth. Rishi Bhishgaathrvvan is the revealer of this mantra and its translation is:

> "*I know with certainty the names and places of 107 medicinal vegetation of deep red color that were born first in three deva-yuga periods before the birth of humans"* .(RigVeda, 10/97/1).

Based on the RigVeda mantra (10/72/3) it was pointed out that it took one *deva-yuga* period of 4,320,000 years from the onset of the creation of the universe for '*vegetation with root system'* to first emerge on the Earth. This mantra (RigVeda, 10/97/1) essentially states in quantitative terms that the vegetation on the Earth appeared first and a period of three *deva-yuga*

(12.96 MY) elapsed since the beginning of the universe for the humans to appear on the Earth. The modern evolutionist may dispute the time period mentioned in these mantras, however, the basic science-thought of the mantra remains indisputable - that the vegetation appeared in this creation before the humans and that the time-lapse between the two events was millions of years. What is also obvious from the mantra is its compactness expressing a science-thought with total absence of any religious overtones. The thoughts in the two mantras, having the association with the specific time periods for the advents of '*vegetation with root system'* and humans, 8.64 MY apart, exhibit the finesse needed in a science-thought, particularly when the specific time period runs not in just the thousands but in millions of years. Such mantras put the Vedic thought closer to the ideas of modern science and remarkably distant from the creation time-lines in other non-science sources. This is substantiated further in the forthcoming chapters where many such mantras containing science-thoughts are presented and the Vedic cosmology scenario for the creation of the universe is delineated.

# CHAPTER 2: Present Understanding of the Universe – A Critical Scrutiny of the Contemporary Big Bang Hypothesis

# Developments in Contemporary Cosmology

Time-to-time brilliant ideas have jumped out of the human mind that has changed the course of societies. Why the ideas jump out of the mind is only minimally understood by the scholarly who study mind. Since human beings are spread all around the Earth the new ideas are jumping out of the human mind all the time all around the Earth. Some ideas are pursued further, developed and implemented by the person who gave birth to them or by the other members of the society. Depending on the nature of the idea and the nature of the society the implementation of ideas may take generations. The persistence in pursuing the ideas builds the knowledge base of the society and leads the society on the path of progress. Therefore, the new advance in human knowledge in a society generally is not in isolation and not completely independent.

All new ideas need further nurturing by others or they will not take root. The implementation of the accumulated knowledge-base by the previous generations of a society serves as the precursor for the advancement of knowledge for the generations to come. The humans having existed on the Earth for millions of years as suggested by modern science and the human erudition still being far from the level of omniscience, repetition of similar ideas in different locales thousands of years apart is highly likely.

In the case of the scientific development of the past several centuries when tremendous strides have been taken, it is several generations of scientists and engineers that have contributed to the present level of advancement around the globe. One scientist's theory, invention or methodology has served as the base for the next level of development. Newton's idea of gravitation and the universal gravitation-constant that he introduced, was there since 1687 CE before becoming a part of Einstein's Theory of General Relativity that Einstein put forward two centuries later in 1916 CE. Einstein's Relativity Theory was there for Georges-Henri Lemaitre to propose in 1927 CE his theory for the origin of the universe; his theory being the Big Bang Hypothesis. That first story of the birth of the universe was by no means completely convincing. The framework of the Big

Bang Hypothesis needed to invoke Quantum Mechanics that was already put forward in 1900 CE by the German physicist Max Planck (1858-1947). A hypothesis being a new idea that jumped out of the human mind faces hurdles in its implementation. Overcoming these hurdles may require implementation of the old and the new ideas. Implementation of such ideas may lead to the inclusion of more hypotheses within the preexisting primary hypothesis. This actually has been the situation in developing the contemporary cosmology theories. However, a general consensus among cosmologists working within the framework of a hypothesis leads to a much needed consolation - that if the hypothesis explained 'most' phenomena of the universe it must be deemed as a 'good' hypothesis and therefore be elevated to the status of a 'physics principle'. In the field of cosmology it is not just the Big Bang Hypothesis that has aspired for the status of a 'physics principle', there are several other hypotheses and methodologies that also have while cosmologists continue to work in that direction. In such a situation the hypothesis that explains 'more' phenomena of the universe with least number of sub-hypotheses in it is said to be more accurate and therefore most acceptable.

Even though none of the present hypotheses in cosmology is proven to be a 'physics principle' yet, several have made great strides in explaining the physical phenomena and the overall behaviour of the universe. The fact remains that as yet not all questions are answered by the existing hypotheses and instead some have even led to new questions. As of now no cosmology theory is complete and the answers to numerous fundamental questions in cosmology remain outstanding.

To review all developments in cosmology one has to attempt to bring in important details from as far as possible in the modern history of cosmology. This has been done by prominent physicists, astronomers and cosmologists through innumerable articles, journal papers and the published books. Therefore, for the sake of continuity and completeness the bare essentials of modern cosmology, that have direct relevance to the age-old Vedic Cosmology Principle and the functioning of the universe as documented by the ancient thinkers in the Vedic Civilization, are presented here.

A limited sample of the science ideas in Veda mantras and the scientific thought in Vedic philosophy was presented in Chapter 1 and their antiquity is established in Chapter 3. There is a span of undetermined millennia between

the two cosmologies and therefore the ancient Vedic Cosmology could not have borrowed ideas from the modern cosmology. Yet this author finds similarity between the basic ideas of both disciplines. Once we are through the Chapters 7 to 10 in Volume 2 of this book the reader would appreciate the numerous similarities between the ancient Vedic and the modern approach to physics; cosmology in particular. These similarities are not just in a few fleeting mantra references on cosmology, they are spread through the different subject areas covered by the Vedas.

The ancient Vedic concepts of Nature's fundamental nature and the Vedic definitions of the entities essential for the creation of the universe seem so fresh and young that reading them in the perfect metered unique poetry of the Veda mantras and pondering upon them makes one wonder when exactly in time the first foundation stone of cosmology was laid in the human civilization? There is no time, locale or DNA restriction on the human mind to pop up a brilliant idea. Therefore it is not necessary that brilliant cosmology ideas popped up only during the past several centuries in given locales on the Earth and that the ancient ideas had to be completely dissimilar from modern ideas. There are major differences between the two as well. Even these differences, pointed out in the forthcoming chapters, would show that they are enlightening enough to generate new thoughts for modern cosmology and may even give it a nudge out of its present groove to create new thinking in the subject.

When we follow the differing cosmology principles or hypotheses for the creation of the universe, the common factor is the matter of the universe, the Nature. Cosmology looks at the behaviour of this matter which appears in the form of the fundamental quanta, the energies and forces at their subtle levels and the colossal cosmos at their macro level. The attempt in cosmology theories is to explain and predict Nature's behaviour on both sides of the timeline. This includes announcing how it all started, how it was, how it will be and how it will end, if it ends. Cosmology has to tell us what the matter is, was it there before the trigger of the Big Bang or was it created out of nothing? Several such questions have been raised in Chapter 1 as well.

To describe the modern cosmology hypothesis it has specific terms and definitions for forces, energies and the state of matter such as matter-antimatter, virtual and real particles and so on. The Vedic creation of the universe also begins with a bang. It could only be considered adequate and worthwhile if it had at least the necessary and appropriate terminology to

describe it. Several terms of the Vedic Cosmology were introduced in Chapter 1 and its richness will become obvious in the chapters to follow. Recall that the Vedic universe in the creation phase (*srishti*) is when the matter is in the definable state (*Sata*-state) and it is in dissolution phase (*pralaya*) when matter goes back to its indefinable state (*Asata*-state). To show the clarity in Vedic thought on the existence of the two states of matter in the two phases of Nature, a part-mantra from RigVeda's *Bhavavrittam sukta* is invoked here:

> "*Preceding the srishti (universe in creation phase), it is not that 'Asata', the indefinable matter was not in existence, it is the 'Sata', the real definable matter that did not come into existence. Then neither the 'rajah', the observable matter and energy existed nor existed 'Vyom', the Space spread out yonder in all directions, the place for cosmos….*" (RigVeda, 10/129/1).

The Nature in Vedic cosmology is exclusively either in dissolution phase or in creation phase. No inter-mingling of the two states of matter ever exists at the same time. The Vedic premise is that if the inert Nature in inactive *Asata*-state of matter was left alone, it will never begin the creation phase of the universe, because, after all what would trigger any change in the *Asata*-state of matter? Consequently the Vedic argument is that an extrinsic trigger of energy was needed to send the inactive *Asata*-state of matter to the active *Sata*-state of matter. This is why the Vedic creation is theistic wherein the switching of matter from one state to another is instantaneous, as fast as a thought. The needed extrinsic thought-energy (mind over matter) comes from the all-pervading Consciousness. A related question on modern Big Bang Hypothesis remains outstanding – what triggers the dimensionless 'space-time singularity' to instantaneously create all matter of the universe, $10^{60}$ kg of it, within $10^{-34}$ seconds?

The above mantra points at the emblems of the creation phase; the *rajah* representing the observable matter and energy in the form of the cosmos and the effulgence of the universe and the spread out *Vyom*, the Space-entity. The *Vyom* by Vedic definition being the Space-entity its function according to the Vedas is to hold the objects of creation. Therefore, the spread out *Vyom* with observable energy and cosmos embedded in it is yet another emblem of the creation. The Vedic thought in the mantra basically clarifies that all these emblems of creation phase did not exist in its dissolution phase. Philosophically expressed, the matter in *Asata*-state is not

into 'being' and while the matter in the *Sata*-state of the universe has come into 'being', it becomes observable in the form of *rajah* the observable matter and energy in the cosmos. In Vedic cosmology the Nature never comes to an end into nothingness, only its state changes from colossal (*Vyom*) in creation to *tuchchhaya* (diminutive) in dissolution.

The mantra emphasizes that the *Vyom* (Space) did not exist then as *"spread out yonder in all directions"* but it did exist in a diminutive confinement. The conterminous Vedic Space-entity with the property of 'stretchability without snapping' being an 'eternal' entity, never disappears into nothingness as a 'space-time singularity' of the modern cosmology. More insight into these Vedic concepts is to follow in Chapters 5 and 6.

What is being said in these mantras about the state of matter (Nature) and the Space-entity is in many ways similar to what is being said in modern cosmology, the difference being in the terminology and definitions of the states of matter. With regard to the geometry of the universe in its *Asata*-state when the *Vyom* is not yet *spread out yonder in all directions* should also not sound strange to a contemporary cosmologist. Even though the Vedic principle with its own space-time confinement of Nature, before it transits into the creation phase, is different from the 'space-time singularity' of the modern Big Bang with no space or time in it, the Vedic space holding the Nature in *Asata*-state is addressed as *tuchchhaya* which means diminutive relative to what it is now as the vast *Vyom*. Thus, in both mechanisms, the modern Big Bang and the Vedic Big Bang, the universe begins from diminutive Space and extends into the vast spread-out *Vyom*. This happens because the expansion of the universe is a pre-requisite in both mechanisms.

More about the Vedic Creation Principle is revealed in Chapter 6 with full interpretation of all mantras of the *Bhavavrittam sukta* ($129^{th}$) of RigVeda's chapter 10. There are specific statements and considerable terminology that exists in these mantras that help create a scenario for the creation process of the universe (in Chapters 7 to 9). Here it would suffice to say that both states of matter at their fundamental level, the *Asata* and *Sata,* are in discrete form made up of fundamental particles called *paramanu,* that cannot be divided further, that serve as the ultimate tiniest building blocks of matter/universe. The *paramanus* in the creation phase enter into their active phase.

There have been attempts to theorize the creation of the universe with and without a Creator. A big name in Christian Philosophy is St. Augustine (354

- 430 CE) who put forward the principle of '*ex nihilo*'. According to his *ex nihilo* principle, God created the universe out of His mere omniscience and omnipotence without any pre-existing matter or physical energy. St. Augustine believed that nothing except God existed before the creation of the universe. This means that no preexisting material-cause of the universe was needed to create the universe. St. Augustine's *creatio ex nihilo* (creation out of nothing) sounds very much like the universe out of the Big Bang's space-time singularity, which by definition is a 'nothing'. The difference however is that in the modern Big Bang Hypothesis St. Augustine's God is out and the Quantum Mechanics followed by Einstein's set of differential equations are in. Contrasting with these theories is the Vedic creation principle where the material-cause of the universe is the Nature-entity manifesting in its diverse forms as matter, energy and forces from its preexistence in another state. Obvious from the above part-mantra from RigVeda (10/129/1), to be elaborated in Chapter 6 later along with other mantras in Chapter 6, is that in the Vedic cosmology, though God is the efficient-cause of the universe the preexisting matter is its material-cause; there is no place for '*ex nihilo*' principle of St. Augustine where 'nothing' except God existed before the creation. In the context of the creation of the universe, the phrase of the RigVeda mantra (10/129/2), आनीदवातं स्वधया तदेकं (*aneedvaatam svadhaya tadekam*) states that "… *Present then* (before the creation) *with Svadha the eternal Nature is the One and none other like Him*…". This means that present before the creation was the Creator (*one of a kind*) with *Svadha*; where *Svadha* is the Vedic synonym for Nature; 31 in Table 5.1 in Chapter 5. In the Vedic *kaaran-kaarya* (cause-effect) the Creator is the 'efficient-cause' and *Svadha* (Nature) is the 'material-cause'.

Now let us jump from the '*ex nihilo*' principle of the 5th century church arena to the 17th century science arena and comment briefly on the Clockwork Universe proposed by Sir Isaac Newton.

## Clockwork Universe Theory of Newton

Sir Isaac Newton (1642-1727 CE), is a big name in science. His interests and expertise covered many branches of science and philosophy - physics, mathematics, astronomy, alchemistry, natural philosophy and theology. He published a remarkable book in 1687 CE, called 'Philosophiæ Naturalis Principia Mathematica' that changed people's thinking and brought

transformation in science. It is this book wherein he described his theory of gravitation and presented his famous three laws of motion that established the foundation for Classical Mechanics. He conducted many experiments of fundamental nature and discovered several laws of Nature. He showed that there was universality in natural laws that governed the motion of heavenly bodies and he advanced people's knowledge by putting forward ideas such as the conservation of momentum and energy. Newton's three laws of motion are well-known. Newton is credited for discovering gravitation and for formulating the 'law of universal gravitation'. Recall that with reference to Rishi Kanaad and his ancient Vaisheshik Sutra eons prior to Newton a brief discussion on *gurutva* (gravitation) was included in Chapter 1 under the sub-heading of "Earth's Gravitation - a Vedic Concept". The Sanskrit term *gurutva*, as treated by Rishi Kanaad in his Vaisheshik Sutra, **stands for nothing else but 'gravitation'.**

## Newton's Law of Universal Gravitation:

> *"Gravitational force between two masses is proportional to their product and inversely proportional to the squire of the distance between the masses."*

The gravitational force between two masses is due to the natural property of matter-matter attraction. The law of gravitation can easily be understood from the following diagram (Figure 2.1) where two static masses $M_1$ and $M_2$ with uniform density are placed at a distance R from each other.

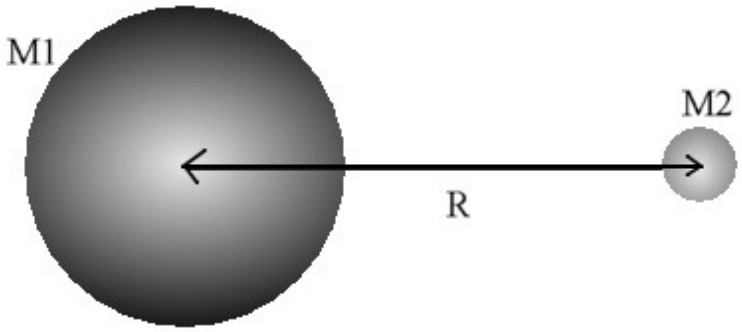



**Figure 2.1:** Two masses M1 and M2 separated by a distance R.

Newton's law states that the mathematical relationship between the force of attraction F between the two masses M1, M2 separated by the distance R is given by the equation,

$$F = G\frac{M_1 M_2}{R^2}$$

Here G is the constant of proportionality between the two sides of the equation. It is called Newton's Universal Gravitation Constant. The term universal is applied to G because its value is non-variant throughout the universe, be it the gravitational attraction between the Moon and the Earth or between two far apart massive galaxies. The distance R between the masses being in the denominator and squired, it is apparent from this equation that when the masses are separated further the force of attraction F decreases faster. If the masses weigh 1 kilogram each and are separated by a distance of 1 meter, the force F = G, the Gravitational Constant itself. The value of G is about $6.673 \times 10^{-11}$ $m^3kg^{-1}s^{-2}$ (meter-kilogram-second unit). In practical terms this strength of the force is extremely small. One would not even detect any apparent pull between 1 kg masses. For this force to become discernible at least one mass has to be enormous, such as the Earth weighing $6.0 \times 10^{24}$ kg. The gravitational force F on a 1 kg mass on the surface of the Earth with its radius being R= 6378.137 km is about 9.84 $m^3kg^{-1}s^{-2}$. This number looks small but in comparison with the force between the two 1 kg masses, it is about 150 billion times in comparison. Owing to the enormity of the force due to Earth's gravitation the pull on a small mass becomes discernible when the mass is let go from hand – it is attracted towards the

surface of the Earth. If Earth's surface-hardness permitted the mass to keep moving, it would end up reaching the Earth's centre where the gravitational pull on the mass is the same from all directions.

When the distance R between the two masses $M_1$ and $M_2$ does not change with time the state of the masses is said to be static. When the state of an object changes from static to dynamic, it is said to be in motion. A moving mass possesses two distinct properties, the momentum and energy. Consider a mass M kg (kilograms) moving with a velocity v m/s (meters/second) in a linear direction, its linear momentum is the product of its mass and its velocity, Mv (kg.m/s). Therefore, a small object with high velocity can have as much momentum as a big object with low velocity.

In addition to the linear motion in an object it could have an angular motion on a curved path, the curvilinear motion; like Earth's orbital motion around the Sun. The motion on a curved path is said to be angular motion because the object in motion keeps changing its angle with respect to a fixed point; the Sun in the example of the Earth. If the Earth's angle with respect to the Sun is changing at a rate of ω radians/sec (Greek letter ω is Earths angular velocity around the Sun. Therefore its angular momentum is Mω (kg.rad/s).

The other term in mechanics is the object's energy owing to its motion. It is called the object's kinetic energy. Without going into the details of mechanics the relationship between the kinetic energy $E_{KE}$, its mass M and its velocity v or ω is given by the equations,

Linear $E_{KE} = \frac{1}{2}Mv^2$,

Angular $E_{KE} = \frac{1}{2}M\omega^2$

The terms such as linear momentum, angular momentum, kinetic energy, gravitational force and gravitational field will be mentioned frequently in the forthcoming chapters. The universe is held together due to the property of gravitation in matter pulling all matter inward.

Newton had deep faith in God and did not exclude the Creator from the creation (universe). His contribution to the philosophical interpretation of Biblical texts is considerable and he believed that the Universe and the physical laws that governed it were created by God. He put forward the "Clockwork Universe Theory". The implication of this theory was that the whole universe was like a clock wound up by God and it continues to run

like a perfect machine with preset laws of physics enabling its perpetuity. He did not elaborate on how matter existed before this creation or what the underlying mechanism was for this clock (universe) to emerge. As it is observed by the scholarly that the "Clockwork Universe Theory" was merely a philosophical statement. Factually, the basic philosophical idea that God was the Creator and the Prime Mover of the universe and that He did this without any external interference in its operation, was around for centuries prior to Newton. Newton's era being the period of 'enlightenment' in the Western philosophy where the 'age of reason' dominated, the clockwork universe theory of Newton was well respected because his laws of gravitation and motion were able to predict the dynamic behaviour of the solar system and the Nature itself as understood during his time. Newton knew that if the universe and its course were already predetermined it could lead to atheism because God in a pre-wound clock-universe was redundant. Several factors seemed to work against Newton's principle for the creation of the universe, the free-will factor in living-beings generally violating physical laws, being the most talked about at the time.

When the two laws of thermodynamics were established, they did not help the "Clockwork Universe Theory". The two laws of thermodynamics are:

(1) *Energy is conserved*, and

(2) *The total entropy (disorder) of any isolated thermodynamic system tends to increase with time, approaching a maximum value.*

The second law of thermodynamics overruled the clockwork principle of the universe, because there was no room for disorder in a universe that was pre-wound by God. Also, along came the 'Uncertainty Principle' in Quantum Physics, which said that nothing in the universe can be predicted with complete certainty. Newton's "Clockwork Universe Theory" did not proceed further.

Accumulation of knowledge leads to inheritance of knowledge. The modern science is richer in knowledge owing to Newton's contribution to that pool of knowledge. Even though his "Clockwork Universe Theory" had no sound mathematical or scientific footing, the current science is indebted to Sir Isaac Newton for advancing the knowledge through his discoveries in different areas and laying a foundation stone for building modern science. In the post-Newton era, while considering new cosmology theories, Newton's

idea of God as the Creator and the Mover of the universe was left behind and also left behind was his Clockwork Universe Theory. Yet his laws of motion and law of universal gravitation and much more that he contributed to physics continued to be extremely valuable. Due to the Clockwork Universe Theory *'the baby was not thrown with the bath water'*. Rather the baby was only the beginning of what was to come and what was yet to be known. Present theories of the universe, be it the Continuous Matter Generation, the Big Bang or the Strings, they all owe Newton for laying a foundation stone of cosmology and enriching the inheritance pool of knowledge in the Western civilization.

The question arises whether the foundation stone laid by Newton is the first for the building called cosmology? Certainly not! There have been foundation stones laid earlier but not necessarily part of the present building. They belonged to an entirely different building in a completely different locale. This locale was in the East. The foundation of that building is still preserved in the form of mantra formulations. Although some stones of the building have gone to other regions of the Earth, still traceable by linguists and historians, the foundation stones have remained behind. These foundation stones are enriched and preserved in the form of the Vedas, a quick commentary on them was provided in the previous chapter. The *rishis*, *munis* (sages, the thinkers) of the Vedic Civilization laid these foundation stones and built on them unique literary monuments in the far antiquity of the human civilization. They did so not to gain recognition, praise or fame but to leave behind this literature in Sanskrit as their gift to humanity for advancing knowledge and to encourage further development.

The *rishis* of the Vedas have stated the principles and the laws that may have implicit assumptions, which may not be suitable for mathematical manipulation or may be non-provable in a physics experiment, but they certainly are at a high intellectual level. They have given consideration to the ingredients and forces necessary for the creation of the universe and based their deductions on the universality of 'cause-and-effect'. A glimpse of this was presented in Chapter 1 under the sub-headings of "Some Cause-Effect Specifics in Vedic Philosophy" and "The Vedic *Kaaran-Kaarya*: Cause-and-Effect Principle". Disagreements on the mechanism of creation are a certainty but modern cosmologists would not have disagreement with the Vedic principle that creation is not possible without the real existence of matter.

# Immeasurability of an Entity

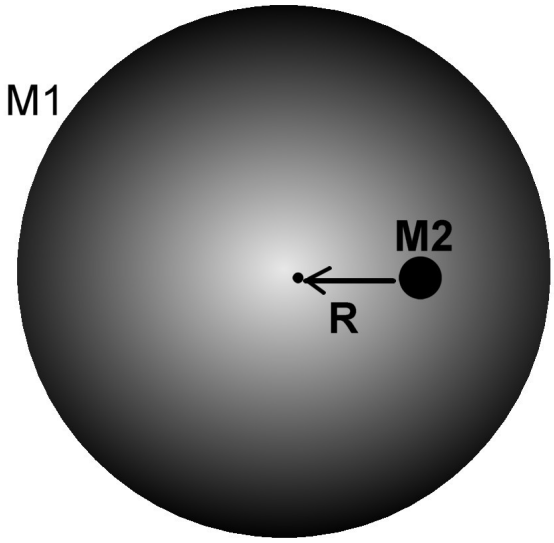



**Figure 2.2 A**

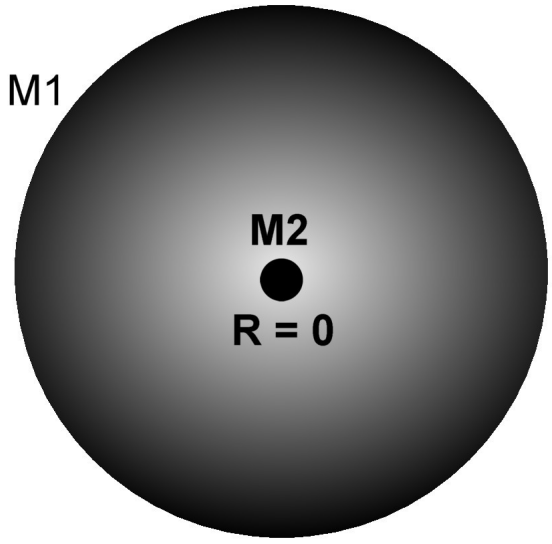



**Figure 2.2 B**

Sometimes we come across statements in the science arena that are true only to a point. At times a criterion applicable to a specific physical system in one realm is generalized for differing realms. For example a statement such as - *'Only the things that can be observed or measured have their existence in the universe'* is not strictly true. The entities like Time and Space are real but not observable and what we measure on Time and Space are their intervals and not their absolute quantities because their beginning is not known. The other limitation is that one is not able to cut a piece of these entities to put aside for later perusal and experimentation. When one moves from physical to metaphysical realm one comes across other forces and phenomena that are incomprehensible; consciousness being one that is immeasurable with tools made of matter. Therefore, owing to these limitations one tends to conclude that the consciousness phenomenon may not even exist.

Here is an interesting conundrum pertaining to immeasurability. Let us revisit Newton's formula for gravitation. Assume that all parameters on the right side of the equation are known. The gravitational constant G is about 9.84 $m^3kg^{-1}s^{-2}$, small mass $M_2$ is 1 kg, the Earth's mass $M_1$ is $6.0 \times 10^{24}$ kg

and Earth's radius R is 6378 km. When the small mass $M_2$ is on Earth's surface the distance R between the two masses is the same as Earth's radius and the calculated force on $M_2$ is approximately $10^{13}$ directed towards the centre of the Earth.

Now let us move the small mass $M_2$ inside towards the centre of the Earth (Figure 2.2A). Because R is in the denominator of the equation, as R decreases the force F on $M_2$ must increase. Finally if the $M_2$ is placed at the centre of $M_1$ the R becomes zero (Figure 2.2B). Dividing by zero means the force $F = \infty$ (infinity). Also the mass of the Earth is in all directions of $M_2$ the force must be pulling $M_2$ equally in all directions. This also means that there is no net directed force on $M_2$ pointing in a given direction. Since the two masses have not changed, therefore the force F cannot be infinity. This is a case of **immeasurability**.

We will now do one final hypothetical experiment with the masses $M_1$ and $M_2$. Let the mass $M_1$ be the mass of the universe, $10^{60}$ kg, as suggested by cosmologists. Let $M_2$ be any small mass. The mass of the observable universe is said to be spread out into a sphere of radius $4.4\times10^{23}$ km. For all practical purposes the boundary of such a sphere is at infinity and the mass $M_2$ for all practical purposes is situated at the centre of the observable universe, as in Figure 2.2B. The contemporary astronomers also suggest that mass of the universe is uniformly distributed all-around. Therefore, a small mass $M_2$ embedded in such a universe will stay put wherever one puts it and will not experience any net gravitational pull to the left or right or up or down. Considering the large dimension of the universe, moving $M_2$ from one point to the other will not change the outcome either. An observer of the mass $M_2$ would quickly conclude that as far as the gravitational force on it is concerned, the mass $M_2$ was not gravitationally interactive with the rest of the universe even though the mass of the universe does have its own gravitational field. Or at least it is as good as not interacting with the rest of the mass of the universe. Since the observer is unable to measure a change in gravitational pull on $M_2$ the observer is unable to use $M_2$ as a probe to infer mass $M_1$ of the universe using Newton's equation even if other parameters in the equation were given. This leads the author to formulate a simple physics *sutra*!

*"The true knowledge of an entity is possible if the knowledge gathering instrument is able to interact with the entity."*

This requires one to make sure that one is using the right tool to detect the right entity. The above discussion on the gravitational field tells us that when one deals with infinitely large quantities and entities one runs into the limitation imposed by 'immeasurability' and the modern cosmology is not immune to it. To visualize this, treat the entire universe as the probing mass $M_2$, embedded in yet another field of force extending to infinity well beyond the universe. The universe with all its physical laws sitting at the center of such an unknown field may not be able to probe that field. The physical universe and its laws may not even be the right instrument to probe such a field. If this field is of metaphysical nature or it is a non-physical pure consciousness, probing it with physical means will be an exercise in futility. Therefore the author draws another physics *sutra*:

"*Futility of detection of an entity is not a proof of the absence of the entity*".

In addition to the *gurutva*-field (gravitation) owing to matter of the universe the theistic Vedic philosophy/physics gives consideration to yet another all-pervading conterminous energy field to which applies the 'immeasurability'. It is said to be a formless, Supreme Consciousness Being (Creator), all-pervading energy field that binds the universe together. Just as a human-being with the inherent property of consciousness has the ability to create thought, alter the chemistry and physics of his own physical body, alter matter and physical events within his area of influence and create tangible things that did not exist before, a Supreme Consciousness Being with His area of influence encompassing the entire matter of the universe could trigger an event such as the creation of the universe. This is the Vedic premise for the existence of the 'efficient-cause' of the universe which does not apply to an atheistic perspective of modern physics/cosmology. The cosmologists under the Multi-universe hypothesis have theorized the existence of $10^{500}$ universes outside ours, forming so-called a 'tree of bubbles' (universes). Because there is no positive proof of Multi-universe hypothesis, the immeasurability applies more to Multi-universe Hypothesis than to anything else. The fact is that none of the infinite and semi-infinite

entities, in the realms of physics or metaphysics, is measurable. Regarding the immeasurability of an entity let us consider the case of electromagnetic radiation (light).

# Fast Particles – Photon and the Munn (Mind-entity)

When one sees a car at its maximum speed one thinks that the car must have been at rest first, then began moving and gradually accelerated to attain a maximum speed. On the other hand when a photon (quantum of light) is produced by an 'excited atom', the atom does not lay the photon next to it like a hen lays an egg! The newly born photon does not remain next to its mother-atom, instead it instantly moves away from the atom. One would think that initially the photon must have been at rest before picking up speed to attain the speed of light, a speed which, according to Einstein's General Relativity, is the maximum attainable by any object in the universe. The fact is that the maximum attained speed of the photon is under measurability but its acceleration, if it exists, is under immeasurability. A photon is thought to shoot out from the emitting atom at the speed of light. One cannot imagine that a photon, like all other objects, attains the maximum speed without some initial acceleration. The maximum speed of the photon in vacuum is 300,000 km per second and a bit less in the air and in the other media. To understand how fast a light photon travels one could compare it with something fast and familiar like a 747 passenger jet propelled with four jet engines at a speed of about 900 km/hour. While it may take about nonstop 45 hours for the jet to complete one round of the globe of the Earth, a photon of light in the same time would have gone around the Earth 21,630 times.

The question, as to why a photon unlike all other objects, has the property to travel from its birth to the death with one speed without initial acceleration, is not an easy one. A photon of light is considered to be a mass-less particle which when shoots out at this speed will maintain its speed, if not hindered by an obstacle or by the medium itself. Once on its way, this packet of energy never gets tired. A natural question therefore is - where does a photon continuously get the energy replenished for its travel to infinity? As it is travelling, nothing from outside is put into it and nothing goes out of it. The photon instantly attaining speed at its source without any sign of initial acceleration in it is also not because the parent atom or a force

within the photon itself gives a tremendous initial push to the photon. This speed of light is the same in any direction.

It may be mentioned here that there is a hypothetical particle that is said to travel faster than a photon – it is called the "tachyon".

In 1962, Bilaniuk, Deshpande, and George Sudarshan first proposed the possibility of particles moving faster than light. For such particles they used the term "meta particle". In 1967, Gerald Feinberg gave such a hypothetical particle another name "tachyon", derived from the Greek word *tachys* which meant "swift". The name tachyon is now used for a particle moving faster than light.

The existence of tachyons will be in violation of the known laws of physics because nothing should travel faster than a photon. The research on tachyons however continues. Scientists at the European particle accelerator announced in 2011 that they had detected a tau-neutrino particle that had travelled faster than light; however, later they announced that it was not a tau-neutrino; rather it was a misdetection owing to *a faulty element of the experiment's fibre optic timing system*!

There is yet another particle in the metaphysical realm, considered in the Vedas and the Vedic philosophy, which not only is said to travel faster than light, it does not need acceleration and reaches its destination instantaneously. Its description in the Vedic philosophy fits into the modern physics expression – "action at a distance". It is called the "*munn*" (pronounced as 'fun'). It is associated with the conscious-being and resides in the *anteha-karan*, the interior-sense-function in the brain of the living-being. A *munn* is associated with consciousness and not with inert matter or energy. Numerous mantras and sutras refer to the speed of *munn*. The mantra references specifically draw its comparison with a photon of light (*mareechee*). The *munn* quantum has instantaneity to acquire infinite speed. It interacts with matter in limited regime without being affected by matter.

That a *munn* is minute, mobile and a unitary entity, one for each conscious-being, has been stated time and time again in the Vedas and Vedic philosophy. So that a Vedic reader understands with clarity that the *munn* is a real dynamic entity and that it has a wide outreach and deep entry, YajurVeda (34/1-6) has devoted six successive mantras on *munn*. The RigVeda in addition to several other mantras in other *suktas* has devoted (10/58/1-12) a full *sukta* with its *devata* being *Munn Aavartanam*. All 12 mantras in this *sukta* are in praise of the *munn* and together they create a

picture telling us that all the subjects mentioned in these mantras are in the reach of the *munn* and that after exploration of the spiritual inner world of a living-being and exploration of the exterior physical world, it returns back into the *anteh-karan* (interior senses) of the body where it belongs.

This author's interest in including a metaphysical Vedic concept, the *munn*, in this section is its relationship to physics. First let us look at the sixth of the 12 mantra of RigVeda (10/58/6), which is related to the *munn*'s speed and then summarize the thoughts contained in the remaining eleven mantras,

यत्ते मरीची:2 प्रवतो3 मनो1 जगाम दूरकम् ।
तत्त आ वर्तयामसीह क्षयाय जीवसे ॥
(RigVeda, 10/58/6)

**Transliteration:** "*Yatte mareecheeh2 pravato3 mano1 jagaam doorkam /*

*Tatta aa vartyaamasiha kshayaaya jeevse* ॥"

**Mantra Translation**:

"*O man, your munn[1] travels afar conquering3 (pravato3) over mareechee[2] the fast-moving-light-rays[2]. I reward you your munn1 to dwell in your living body all through your cyclic birth process*". (RigVeda, 10/58/6).

The term मरीची:2 (*mareechee*), in a Sanskrit dictionary and in mantra interpretations by ancient Sanskrit scholars, stands for '*particle of light*' which is no different from the physics term - 'photon'. The meaning of मरीची:2 as a '*particle of light*' has not entered into the Sanskrit dictionary after the term "photon" was coined in physics in 1916 or after the corpuscular nature of light radiation was recognized in physics. The Sanskrit term *mareechee* is as old as the Vedas and its meaning '*particle of light'* is also as old as the Vedas. Therefore the Veda treating light as a

discretized phenomenon, by itself is remarkable. In whichever way one looks at the term *mareechee*, it represents a physics definition of light photons. At this point, this author is tempted to say that the Vedic *rishis* through the mantras have presented deep insight of a phenomenon in physics - mind-boggling indeed. There is much more to this mantra than just the definition of a photon. Please read on.

In addition to the term *munn*1, the other important term in the mantra is प्रवतो3 (*pravato*). The elemental term प्रवन् with verb conjugation yields the term प्रवतो3 (*pravato*); the *munn1* being the subject. Based on other mantra interpretations and on the ancient dictionary of Vedic terms, a translation of प्रवतो3 is '*one that conquers*'. The other same root-based translations are - '*one that gains on*' as in a horse race, or '*one that aims at*' or '*one that targets something*'. That something in the mantra is *mareechee* the photons of light and the conqueror is the *munn*1. At this point the simple logic becomes obvious. When an archer aims his arrow at a moving target, for the arrow to 'gain on the target', the arrow has to travel faster than the target itself or the whole exercise of shooting an arrow is meaningless. In this mantra the chaser is the *munn*1 and its target is *mareechee* – the light photons. One does not attain victory over an adversary without catching up to the adversary. Therefore, the logical conclusion of the RigVeda mantra is that the *munn*-entity of the Vedas, associated with the consciousbeing, travels faster than light.

The implication of the second line of the mantra is that the *munn* of a person repeatedly goes out and comes back to the same person without getting lost in the universe and that the Creator endows it cyclically to the conscious-being every time he/she/it is born through the cycle of birth-death-rebirth.

The most important find here is that the *rishi* chose light rays to compare the speed of the *munn* and not the wind or a fast running horse or a flying arrow. To choose light, the fastest known entity in physics, for comparing it with the speed of *munn*, is simply mind-boggling.

There is no equipment or experiment in the physical sciences that could measure the speed of this metaphysical real entity called *munn*. The question here is – how can something like the *munn* with the unusual properties defying physics laws exist, claiming to be residing in the head of the living-being and not be detected? This question is meaningful when

opined in the frame of reference of modern physics with a premise that all things and phenomena of the universe are explainable in physics frame of reference. The premise however is not all-encompassing. There are many things in the universe that are not understood! Several pertinent questions were raised in Chapter 1. Additionally - why is there the phenomenon of 'desire' in living-beings at their varied levels of evolution and why is the desire only in living-beings and so on? There may be reference frames other than the physics reference frame that we have not discovered yet and there may be reference frames that we do not have the ability to discover. There are many logical questions that belong to different frames of reference. Therefore, what if the *munn* is a real phenomenon outside the 'measurability' condition of modern physics?

# The Five Principles of Modern Cosmology

A contemporary theory of the universe is only the theory of the 'observable universe' that the astronomers are able to observe with their most powerful telescopes. A theory that explains most of the observations from the observable part of the universe is deemed a good theory and is then generalized for the rest of the universe that might exist beyond the observable universe. Since the existence of conscious-beings is a cosmological reality, a cosmology theory is incomplete if this reality is not addressed in it because one cannot disregard the phenomenon that is responsible for excavating cosmological theories and asking intelligent questions.

To better organize the approach for developing knowledge of the universe, cosmologists have adopted five basic principles to guide them towards the ultimate brilliant discoveries from the cosmos. These principles are listed below.

**(1) The principle of uniformity**:

'*The laws of physics, verifiable in the laboratory, that apply to the observable objects, apply to all objects of the universe*.'

**(2) The Cosmological Principle:**

'*Except for local irregularities, the universe is homogeneous and isotropic* (uniform density in all directions)'.

One of the cornerstones of modern astrophysics is the cosmological principle. The basic premise of the Cosmology Principle is that the observers on Earth have no privileged view of the universe and that the laws of physics must be the same everywhere. Many observations back up this premise. For example, the universe looks more or less the same in every direction, having the same distribution of galaxies everywhere we look.

In recent years, however, some cosmologists have begun to suspect that the Cosmological Principle may be wrong. They point to the evidence from the study of Type 1 supernovas, which appear to be accelerating away from us, indicating that the universe is not just expanding but accelerating away. The curious thing is that this acceleration is not uniform in all directions. Instead, the universe seems to be expanding faster in some directions than others. But how good is this evidence? Is it possible that the preferred direction is a statistical mirage that will disappear with the right kind of data analysis?

Rong-Gen Cai and Zhong-Liang Tuo at the Key Laboratory of Frontiers in Theoretical Physics at the Chinese Academy of Sciences in Beijing have re-examined the data from 557 supernovas throughout the Universe and re-crunched the numbers. They confirm that the preferred axis is real. According to their calculations, the direction of greatest acceleration is in the constellation of Vulpecula in the Northern hemisphere. That is consistent with other analyses and also with other evidence such as other data showing a preferred axis in the cosmic microwave background radiation (CMB). This has caused the cosmologists to rethink about the validity of the Cosmological Principle itself. But it also raises exciting questions: why does the universe have a preferred axis and how should it be accounted for in the Big Bang model?

More will be said on this preferred axis of the universe in Chapter 9 on the Vedic Big Bang Scenario where mantras after mantras state that the universe is a spinning system, spinning around a *Skambha* of energy, the physical axis of the universe. A spinning universe is a unique Vedic idea where the *Skambh* is the pillar of energy going through the centre of the universe, serving as its axis of rotation. This is in the likeness of a bar in the centre of a galaxy around which the entire galaxy spins. The consequence of this Vedic idea is discussed in detail in Chapter 9 where it is also pointed out that the hypothetical Dark Energy, thought as the only possible expanding force of the universe in the modern Big Bang cosmology may not be a reality. The rotation of the universe right from the onset of the universe along with the property of gravitation can explain the expansion of the universe and the associated red-shift in the spectrum of the far away galaxies.

**(3) The Anthropic Principle:**

*'The laws of nature and the values of the fundamental constants of physics are so critically just right that life is enabled on Earth and the intelligent conscious-beings are capable of observing the universe'.*

**(4) The Principle of Equivalence**

'*All bodies made up of matter or anti-matter have positive or zero mass and that the gravitational mass and inertial mass are equivalent*'.

**(5) The Mach's Principle:**

'*The inertia of every body is by the distribution of matter in the universe'.*

These principles help in building a cosmology theory except that for most cosmologists the Anthropic Principle (AP) continues to be a sticky point. This is because a scientist has to explain why the probability of life occurring on the Earth is tied to the laws of Nature so much so that even minute changes in them will not enable life on the Earth – it is as though the Nature's laws were designed to have life on the Earth. Most scientists think that there is nothing special about having life on the Earth because life on the Earth is just another accidental phenomenon. Most biologists are completely satisfied with Darwin's theory of evolution of the species leading to higher intelligent beings, the humans.

The problem with regard to the AP that a cosmologist/physicist faces is the one created by cosmology/physics itself. Physics has yielded several universal constants related to the nature of matter and the laws of Nature, measured as well as calculated. The values of these universal constants are so critical that if they were slightly different, the life on Earth would not exist and therefore intelligent life on Earth would not exist in the first place to derive these constants. So, the problem is – why is the universe in such a critical balance? Under the AP they feel that they have an obligation to explain this phenomenon of criticality of physics constants leading to the existence of life. While the other four cosmology

principles help set up the boundaries of the framework for developing cosmology theories, the AP is part of the query on which to keep an eye but is not effective in building the theories. Cosmologists have come up with the explanation for the AP; however, to find an answer they have resorted to

hypothesizing about other universes outside our own wherein there is no life.

Therefore there seems to be an apparent disconnect between the AP and the other cosmology principles. The Vedic perspective on this apparent disconnect is a subject of another book where the discussion leads to a positive connectivity between the two dissimilar realms, matter and consciousness; after all the AP arises due to the existence of the phenomenon of consciousness. The take-off point for the Vedic rishis' creation principle is in the simultaneity of both, the consciousness and the matter.

Because the forthcoming chapters are devoted to the subject of cosmology from a completely different time in human history and from a completely different discipline of thought (the Vedas), it is of benefit to the reader to first know the modern advances in cosmology. The foundation of all modern cosmology theories is the use of hypotheses, at times counter intuitive and unreal. The soundness of a theory is justified by the premise that they are mathematically valid and yield convincing explanations for what is being observed in the universe.

Presenting an in-depth knowledge of contemporary cosmology is beyond the scope of this book; however, it is essential that at least a qualitative overview of some of these cosmology hypotheses is presented here and the broad features are discussed. Wherever necessary the contrasting and relevant Vedic ideas are brought in to show that the latter are the outcome of highly disciplined minds, are scientific in their basic character and are sufficient to portray an interesting picture of cosmology. If nothing else, these ideas make one wonder as to what made those Vedic rishis to come up with cosmological principles so far back in human history. These ideas, devoid of myths or mythical characters, are at a qualitative level but they certainly raise the question – why are they similar to the ideas emanating from the thinkers of modern times while being unique, mysterious and distinctly dissimilar? Not just that, but these ancient ideas pose questions for the modern scientists, which are closely related to the present reality of cosmology.

# Modern Cosmology Theories of the Universe

In 1927, Lemaître put forward the cosmology theory according to which the universe had a beginning with an enormous explosion at one dimensionless point. This theory popularly known as the Big Bang Theory is presently the most accepted cosmology theory. However, it is not a final theory yet because not everything about the assumptions in the theory and about the universe are explained by it and there are several problems with the theory that have been pointed out and discussed by other groups of cosmologists. In the following a broad outline of the Big Bang Theory is presented first and then some of its limitations are discussed that have led to uncompromising opposition by a good number of scientists. To strengthen the Big Bang Theory itself the Big Bang cosmologists have introduced several approaches and hypotheses. These include the so-called inflationary theories; vacuum fluctuation theories, time-independent theories, strings theories and so on. Physicists, with all these approaches, have been able to explain several observed phenomena of the well-established universe yet the true nature of the matter of the universe, right after t = 0 seconds of the big explosion, is still not fully understood.

The Time-entity in most of these cosmology theories is crucial. Even though this entity is not understood fully by the modern cosmologists, all things happen within it, thus making it a part of the cosmological development. A fair bit of discussion on the nature of the eternal entities, Time, Space and Nature, was included in Chapter 1. Some cosmologists have recently said that the Time is only an illusion of the mind. Others have said that it is real but began at t = 0 seconds of the Big Bang. A Vedic principle states that anything created in the universe cannot be a continuum. The illusion or a reality the Time is seen as a continuum. If quantized a cosmologist is unable to define its quantum. Pertaining Time there are three types of modern cosmologists: the traditional Big Bang cosmologists believing the birth of Time with the birth of Big Bang, the new cosmologists who work with time-independent field equations and those who consider the existence of Time before the t = 0 sec of Big Bang.

The Big Bang singularity being a non-descript entity, there is no history hidden in it which may be related to Nature's pregnancy period before the time-zero of the Big Bang. The metaphor of Nature's pregnancy is meant a

preparation period such as prescribed in Vedic Big Bang when well-described primordial Golden-ovate spun in *paryaplava* (rotation while flotation) around an axis and developed *tapsah*, the heat energy, before the tremendous explosion broke it into 'uncountable pieces'. This period of Nature's pregnancy according to the Vedic references is one *dava-yuga* of 4.32 MY. May be someday the complexity of the cosmology theories of the universe will be as understandable as a reality in our daily lives, like the birth of a newly-born where its physical growth during pregnancy is comprehensible and finally the growth of the body is comprehensible. The Nature itself was that metaphoric egg of matter, waiting to burst opens its shell. Contrary to presenting a simple picture of the advent of the universe the modern cosmology is heading towards complexity. The account of this complexity is beyond the scope of this book. It is intuitive to think that if the increased complexity was a necessity to explain a theory, the theory may have had a wrong start!

## The Contemporary Big Bang Hypothesis

If a force is applied to a stationary object the status of the object changes. It is displaced to occupy different space. This displacement relative to a reference point over a given time is seen as the motion in the object. The displacement relative to the reference point and body's new position after a given time are part of a frame. This reference frame is termed as the 'observational frame of reference' or the 'inertial frame of reference'. The branch of physics wherein the behaviour of an object is studied in an 'inertial frame of reference', under the influence of forces and the applicable laws of nature, is called mechanics. Science of mechanics has been developing since 'early modern' period, the period of Galileo Galilei (1564 – 1642), Johannes Kepler (1571-1630) and Newton (1642-1727). It is referred to as the 'Classical Mechanics'. With his laws of motion because Newton contributed very significantly to the 'Classical Mechanics' it is also popularly known as Newtonian Mechanics.

In 1905 Albert Einstein with his Special Theory of Relativity revolutionized the way the state of an object was thought. He brought the Newtonian Mechanics into a new realm where two separate entities, the Space and the Time were brought together to be dealt as a single entity called the 'space-time continuum'. According to the Special Theory of

Relativity the state of rest and the state of uniform motion, mentioned in Newton's first law, was not absolute, rather it was only relative. Therefore the Special Theory of Relativity is in fact an improvement over Newtonian Mechanics. The objects moving at very high speeds were to be treated with laws at one level higher than in Newtonian Mechanics. This gave birth to the new term 'Relativistic Mechanics'. That the speed of light was the fastest in the universe, as mentioned in the above text, is an important outcome of the Special Theory of Relativity. When the speed of an object is small compared to the speed of light there is no difference between the outcomes of Newtonian Mechanics and Relativistic Mechanics.

In addition to several other outcomes of the Theory of Relativity an important outcome was the equivalence of mass and energy. This means that matter can be converted into an equivalent amount of energy. Mathematically, the mass m and its equivalent energy E are related through the famous mass-energy equation of Einstein, $E = mc^2$ where c is the speed of light.

Einstein introduced the idea of curved space-time in 1916 and published his theory as the Theory of General Relativity which unifies the Special Relativity and Newton's Law of Universal Gravitation. Einstein published a set of ten equations known as Einstein's field equations which take into account the fundamental force of Nature - the gravitational force. He represented the gravitational force as a curved space caused by the presence of matter. It can be said without going into the details of its outcomes that the gravity now was seen differently than before and was just a property of the geometry of space and time. When the universe is thought as nothing but mass, energy, space and time, Einstein's field equations opened a window of opportunity for the physicists to apply them to study the behaviour of cosmos and try to solve the outstanding puzzle; the beginning of the universe.

Although the space-time relationship is applicable to the universe where the embedded heavenly objects are found in perpetual motion, Einstein first believed that the universe as a whole was a static system. Contrary to this belief, a Russian physicist Aleksander Friedman (1888-1925) using the solution of Einstein's field equations published in 1922 his theory of the expanding universe. Georges-Henri Lemaître (1894-1966), a Belgian Roman Catholic priest, a mathematician, an astronomer and a professor of physics, applied Einstein's General Theory of Relativity to

cosmology. In 1927 Lemaître published the 'Hypothesis of the Primeval Atom' where he deduced that the universe began with the explosion of a primeval atom and as in an explosion the material started to fly outward. The matter of the universe contained in this dense primeval super-atom burst creating fireworks of galaxies spreading out in a growing sphere from the centre of the burst. He theorized that this explosion, which started at a single point, was the beginning of Time, implying no Time existed before the onset of this gigantic explosion.

The British astrophysicist Sir Fred Hoyle (1915-2001), who was in disagreement with the theory, sarcastically coined the term Big Bang for this big explosion and the name Big Bang stuck to Lemaître's 'Hypothesis of the Primeval Atom'. The astronomers and cosmologists in the recent past had determined differing ages of the universe and with more accurate measurements of distant galaxies they have arrived at a consensus, that the Big Bang took place about 13.8 BY (billion years) ago when it threw matter and energy out in all directions with tremendous speeds. The universe thus is an ever-expanding system since t = 0 sec of the Big Bang.

After Friedman died in 1925, Edwin Hubble in 1929 discovered from his observations of distant galaxies that their light exhibited Doppler shift towards the red part of the light spectrum that they emitted. This meant that the distant galaxies were flying away from each other at an increased speed and therefore the universe indeed was expanding and was far from being static as Einstein had once postulated.

The Doppler shift or Doppler Effect is the change in frequency (or wavelength) observed by an observer when the object producing it is moving toward or going away from the observer. An example of this is an observer standing by the train-track and listening to the whistle of the engine of a fast approaching train. If for example the whistle of the engine was tuned to the middle C note of a piano at the frequency of 261.6 Hertz (Hertz = cycles/sec), the observer will hear the whistle detuned from C toward C-sharp (increased in frequency) when the train was coming toward the observer. When the whistling engine of the train passes the observer, the observer hears the C note and as the train rushes away from him the note C drops toward the lower note B at the frequency of 246.94 Hz. The sound waves travel in the air at a speed of about 1,235 km/hour. The calculation suggests that for one to hear a shift of a complete note from C down to B, the engine has to travel away from the observer with a speed of about 73.4

km/hour. Conversely, if one measures the shift in frequency, one can estimate the speed of the train. The same principle is used in astronomy to estimate the speed of faraway galaxies using the observed shift in frequency of light that they emit (instead of sound in the case of an engine).

The subject of the sense-organ for sound frequencies is the ear and the subject for the sense-organ for light is the eye. As sound is emitted at different frequencies in the audio range, example being many octaves of piano keys, light is also emitted at a wide range of frequencies called a spectrum. A spectrum in the visible range exhibits colours that a human eye differentiates. Seven colours in the solar spectrum is an example. Of this spectrum, the human eye can see from the red colour (lower frequencies) to the blue (higher frequencies). Therefore, if a distant galaxy was observed with its spectrum shifted toward red, the obvious conclusion was that it was moving away from the observer. Even though the ultimate determination is achieved with a sense organ the accurate detection in the spectrum shift is carried out by the photo-electric spectrometer technique coupled with the telescope. Hubble discovered from his astronomical observations of faraway galaxies that their spectrum was shifted towards the red-end of the spectrum. He also observed that the farthest the galaxies the greater the redshift and therefore the faster they were receding away from the observer. Since then the ever-expanding universe became a permanent feature of the Big Bang Hypothesis. However, the source of the red-shift in the spectrum of galaxies is not free of discrepancies. Nevertheless, the Big Bang Hypothesis is the most accepted hypothesis for the origin of the universe.

Lemaître believed that the Big Bang was a unique event and that the universe would keep expanding with cosmos receding from each other as in the case of the fragments of an explosion and will not return to the original point of explosion. If the universe continues to expand it will attain extremely low density and become extremely cold and end up in a ‘Big Chill’ - a favorite term in cosmology for this scenario. The reason for the fragments of an ordinary explosion on the Earth not returning to the origin is that the origin does not attract them back. If it were not for the massive gravitational attraction of the Earth bringing fragments of an explosion down from where-ever they have reached, the moving fragments would follow Newton’s first law and would continue to fly away from each other.

Contrary to the universe ending in Big Chill, Stephen Hawking made a prediction that the gravity of the universe itself would slow the expansion

down and make the universe fall back toward its centre. If the universe starts to reverse under its own gravity, it will collapse back to where it started. The popular expression in cosmology for this fate of the universe is the 'Big Crunch'. The Big Crunch should ultimately turn it into the original space-time singularity. Then the natural question is what would happen to it at that point? What will prevent it from exploding again and create another universe? And what happens to the Time and the Space entities? Do they get crunched as well? There is no specific logic to disregard the argument that in a Big Crunch the universe will not go back into its original state of 'singularity' and there is no sound logic to suggest that it would not explode again and begin creating another universe. Therefore, intuitively one can surmise that the creation-dissolution is a cyclic process, just what the Vedic Cosmology Principle has suggested; albeit with differing steps and time epochs.

Some modern cosmologists have in fact started to believe that the universe would shrink to a point in space and another Big Bang would occur. This would make the process repeat endlessly. Philosophically this condition is termed as 'eternal'. The term in Vedic Philosophy for this cyclic behaviour of the universe is *srishti-pralaya-chakra* (creation-dissolution-cycle).

The Big Bang Hypothesis must provide answers to several related questions. If the Time has a beginning at t = 0 sec of Big Bang, it must have an end in the Big Crunch. Does Time die when the Big Crunch comes? What creates the Time and what causes it to age? What causes it to be born again after Big Crunch? For the Time to die in Big Crunch, the Time has to start reversing sometime in the life of the universe and end up going as low as Planck-time to come to its death at Big Crunch. Would it do that? Or instead of reversing, does it face a 'sudden death'. If the answer to the question is that the Time does not die in Big Crunch but continues increasing through the Big Crunch it would create a time-dilemma:

*- "that a new Time is created after each Big Crunch in the presence of the old Time still running, thus rendering infinite number of different Times running parallel".*

The answer – that the Time is what the field equation or a computer algorithm created at t = 0 sec in a given mathematical step, is not sufficient. If the Time is a real entity that participates in the birth of a real universe the

answers to these questions have to come from outside the frame work of the cosmologist's field equations wherein there is no mechanism to create time with its initial ingredients.

As has been said before the universe according to modern Big Bang Hypothesis emerges at Time = 0 sec out of nothing when its density and temperature are infinitely high. The temperature is measured in degrees Kelvin (° K). The Kelvin Temperature scale begins at zero ° K which on Celcius scale is - 273 ° C. When a substance is at 0° K (- 273 ° C) it is said to be at Absolute Zero Temperature. When it is said that the temperature of space-time singularity, before the Big Bang, was infinitely high it means that it is unimaginably high!

The enormous explosion breaks the Big Bang singularity and within an infinitesimal fraction of a second, between time t = 0 seconds and $10^{-43}$ seconds (1 second divided by the number with 43 zeros after 1), the universe expands to acquire a size of a ball with radius of $10^{-35}$ cm (centimeter) and its temperature drops to $10^{32}$ ºK. To put it in common expression, the universe within 10-trillion-trillian-trillion-millionth of a second grows to the size of a dot with a radius of only about 100-trillion-trillian-billionth of a centimeter with the temperature dropping to about 100-trillion-trillian-million ºK. Because the Time-entity and the Space-entity are also said to have been born in the Big Bang, they also grow from t = o second onwards.

This negligibly small time duration of about $5.4 \times 10^{-44}$ sec (about $10^{-43}$) is known as the Planck-time after Max Planck who is also credited to be the founder of Quantum Theory. The radius length of about $1.616 \times 10^{-35}$ meters that the universe acquires at the end of Planck-time is known as the Planck-length. The Planck-time is the duration of time that light takes in vacuum to travel one Planck-length. Therefore it is assumed that the matter of the universe travelled at the speed of light. The state of matter within the Planck Era is such that the regular physics principles do not apply to it and therefore logically no information about its state can be extracted. Physicists define this state of matter as "complete symmetry". By that is meant that up to Planck-time there is no material diversity in the matter of the universe. The whole matter is said to be of one kind, whatever that is! From all standards of measurability and perceptibility the matter of the universe in that time duration is just an indefinable, invisible and immeasurable blob of matter.

The birth of the universe begins with the creation of the building blocks of the future universe. These building blocks are the fundamental particles of

matter. This also means that the Nature or the matter of the universe is not a continuous entity. The entire matter of the universe seen in all its states, properties, shapes and colours is basically made up of tiny corpuscles. These fundamental particles are not of many types; rather they are countable on finger tips. It is their combinations in different proportions under different laws of Nature that creates such diversity in Nature from micro to macro level. The hypothesis for the birth of the universe has to keep an eye on the model that explains how the primary building blocks of matter interact with each other and under what laws they create the early universe. This model is the Standard Model in particle physics. The physicists have developed this model over a period of a century which explains how the fundamental particles behave with each other and what the relationship is between each and what forces govern their participation in the universe. A brief overview of the fundamental particles and the forces governing the matter of the universe is presented in the following.

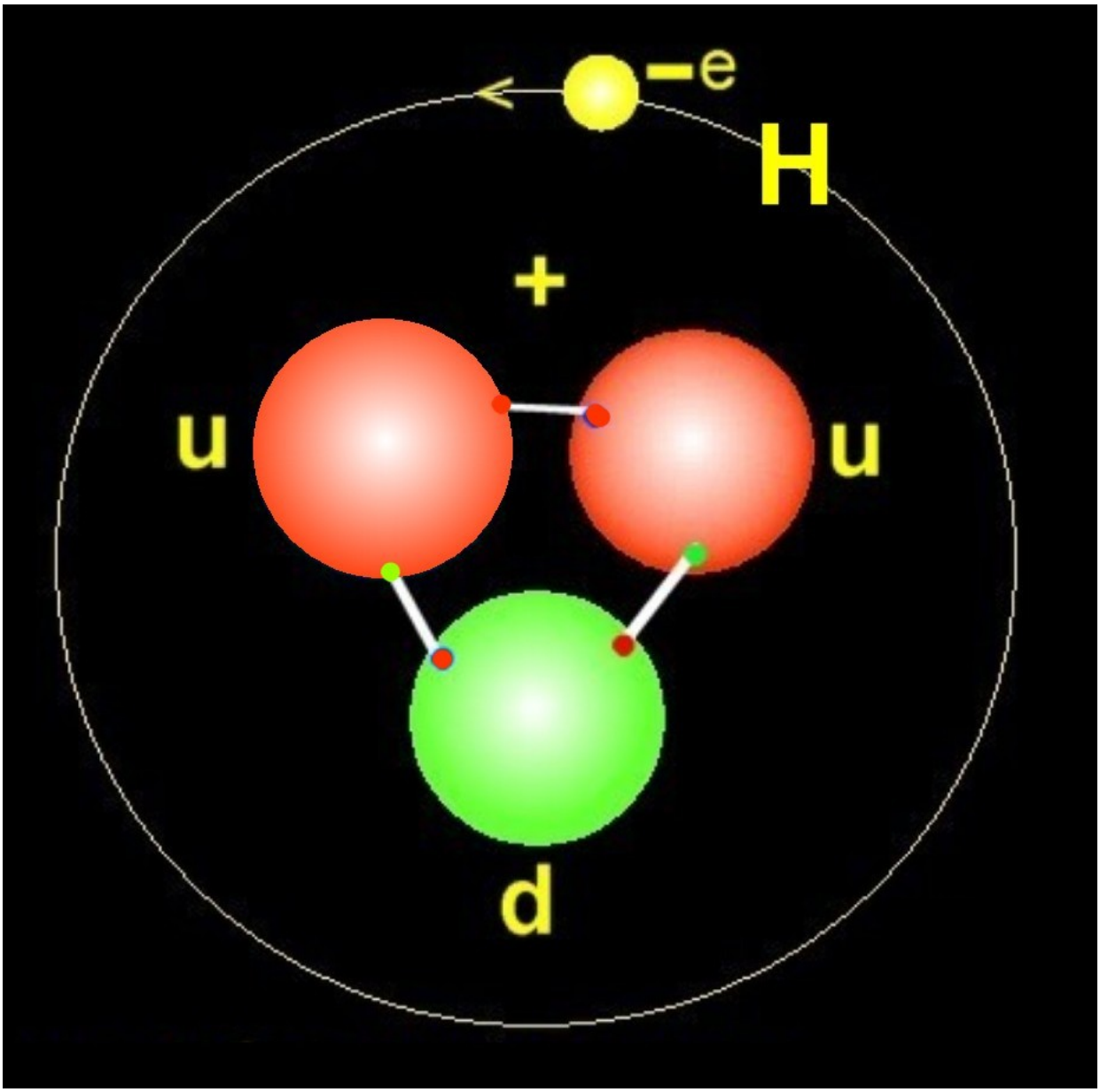
## Fundamental articles

The fundamental particles are of two types, named quarks and leptons. There are six different particles in each type, grouped in three pairs each under the label of 'generation' - first second and third generations. This classification is shown in Table 2.0. The 'first generation' quarks and leptons are the lightest and most stable. The 'second generation' and 'third generation' particles are heavier and less stable. Second and third generation heavier particles quickly decay into smaller and the next most stable particles. It is the 'first generation' quark pair and lepton pair that form the commonly measurable and observable stable matter of the universe. The electron, muon and tau, all have an electric charge and the extremely light neutrinos are electrically neutral. Quarks are not found free in nature. They are all used up in forming the nuclei of atoms of elements of the universe.

The larger particles are formed with multiple quarks and they are called hadrons. Hadrons decay into stable hadrons and other particles. The stable hadrons are the nuclear particles named protons and neutrons. Two up-quarks (u) and one down-quark (d) form one proton which is a positively

charged nuclear particle. In the same way two down-quarks and one up-quark form a neutron which is a charge neutral nuclear particle.

| **Table 2.0: Nomenclature of Quarks and Leptons.** | | | | |
|---|---|---|---|---|
| **Particle Type** | | | | |
| **Quarks** | **Generation** | **Leptons** | | |
| 1 | Up-quark | First generation | 1 | electron |
| 2 | Down-quark | 2 | electron-neutrino | |
| 3 | Charm-quark | Second generation | 3 | Muon |
| 4 | Strange-quark | 4 | muon-neutrino | |
| 5 | Top-quark | Third generation | 5 | Tau |
| 6 | Bottom-quark | 6 | tau-neutrino | |




The smallest atom in Nature is the Hydrogen atom formed by one proton with an electron orbiting around it. The nuclei of elements heavier than Hydrogen have both, the protons and neutrons.

It was mentioned in Chapter 1 and will be discussed in detail in Chapter 5 that for the Vedic science and philosophy the *Prakriti* (matter of the universe) is inert and quantized (corpuscles) into a triplet of fundamental particles called *aapah* with three types within it, the *sata, raja* and *tama*, each with different property. According to the Vedic thought, all substances and forces in the universe, in physical and metaphysical realms are formed

out of differing combinations of these three types of fundamental particles. It is mind-boggling that the ancient Vedic *rishis* should have found that matter at its fundamental level is quantized into three types of particles and not a single type. Is it a coincident that a triplet of quarks must form a stable nuclear particle, proton and neutron in modern physics?

## Four Fundamental Forces of Nature

What keeps the tiny quarks and electrons bound together to form the atoms of elements in Nature, what creates conglomerates of atoms and molecules to form great celestial objects, what keeps the celestial objects bound to each other as in the solar system and what ties together the solar systems (stars) in a galaxy to form galaxies? The answer to all these questions is – the forces. Not one or many forces but exactly four different fundamental forces that operate in their individual regimes. After the matter is created in the Big Bang and it goes through the Planck Era, a total of four types of fundamental forces in Nature are revealed that continue as a permanent feature of the universe. Owing to their strength, effective range, nature and properties, they are named as - 'Strong Force', 'Weak Force', 'Electro-Magnetic Force' and 'Gravitational Force'. A few salient features of these forces are mentioned here briefly.

These forces are distinct, diverse from each other and effective in their respective realms. Not one is derived from the other. The 'Strong Force' and the 'Weak Force' are effective in very short ranges at sub-atomic levels; of the order of $10^{-13}$ cm. The 'Strong Force' owing to its property of strong attraction holds the nuclei of atoms together. If this force was not as strong as it is, the nuclear particles forming the nucleus of different atoms will fly away from each other putting an end to the diversity in matter. The 'Weak Force' is responsible for radioactive decay of elements. The 'Electro-Magnetic Force' creates all electric and magnetic effects. It is responsible for the attraction between the negative and positive electrical charges and the opposite magnetic poles and it is also responsible for the repulsion between similar charges and similar magnetic poles. It manifests between pieces of matter that carry electrical charges. Fourth force, the 'Gravitational Force', causes attraction between matter and matter owing to the property of mass in matter. The 'Electro-Magnetic Force' and the 'Gravitational Force' operate up to the infinite range and the former is many times stronger than the latter.

The ‘Weak Force’ is weaker than both, the ‘Strong Force’ and the ‘Electro-Magnetic Force’, but it is much stronger than the ‘Gravitational Force’. It is the ‘Gravitational Force, operating over the cosmological scales, that is most important in the space-time context of the functioning universe. It is this force that keeps the celestial objects bound to each other. These four forces are also the physical laws of Nature governing the matter of the universe. The absence of even one or even a slight change in any one of them will not enable the type of the universe we have or the universe may not even form.

None of these forces that create diversity in nature existed before or during the Planck-time of $0.539 \times 10^{-43}$ seconds, from the t = 0 seconds of the universe, but the matter of the entire universe was created during this short time period. This state of new matter is not definable by physics. This is as good as saying that the state of matter at that point in time is Veda mantras’ *Asata*-state of matter.

## What Creates Forces in Nature (Matter)?

According to the modern physics / Quantum Physiscs the force between two fundamental particles is created by the exchange of packets of energy. These packets or corpuscles of energy are known as the force-carrier particles. The particle physics term for these discrete particles is “bosons”. This exchange is depicted in the figure between the ‘u’ and ‘d’ quarks. Each force has its specific boson symbolically shown in Figure 2.3 with small dots on ‘u’ quarks originated from the ‘d’ quark and the dots on ‘d’ quark originated from the two ‘u’ quarks. The force carrier boson for the “Strong Force” is named as the “gluon” and for the “Weak Force” it is named as the “W and Z boson”. The force carrier particle of the “Electromagnetic Force” is the “photon”. The force carrier of the “Gravitational Force” is supposed to be a particle of gravity named “graviton”, but it has not been discovered yet. Even without the discovery of a “graviton” the “Gravitational Force” is independently dealt with successfully in the Theory of General Relativity.

Physicists believe that all four fundamental forces are unified in the Planck Era into one single force. But unified into what is yet to be discovered by the physicists. In theory anything can exist but it may also be possible that some of these forces were not even born yet in the Planck Era! When this is put to a logical test it reveals a few things. Because there is no diversity in matter in the Planck Era the ‘Gravitational Force’ owing to

mass-mass attraction could not have been born yet. Mass in a particle is said to have been imparted by the well-defined but not discovered yet Higgs particle in undefined matter of Planck Era, the 'Gravitational Force' could not have been there either. A brief commentary on Higgs particle is in the Vedic creation scenario in Chapter 8. Physicists in their effort in developing the Standard Model to unify all forces have been able to unify three of the four forces but the 'Gravitational Force' continues to be beyond the grasp of this unification. The basic question remains – when and why the Nature created these forces?

## The Vedic Perspective on Force Transfer

To the best of this author's understanding the Veda has not explicitly defined the four forces. However, the Vedas do have a perspective on the transmission of two forces from one point to the other; the two forces being the electro-magnetic force (light) and the gravitational force. A brief discussion on this ancient perspective is presented below.

In modern physics these two forces are transmitted in the form of waves with their force-carrier particles respectively being photon and graviton. These forces do not need a medium for transmission. They transmit better in vacuum. The electro-magnetic force instead travels the fastest in vacuum with a maximum speed of $3x10^8$ meters per second which is the speed of light. Contrary to this the other forces of mechanical nature like the sound waves do not have a force-carrier particle and need a medium to transfer and do not travel in vacuum. The force of sound creates a compression wave in the medium which travels from one point to another. Thus we observe that some forces need a medium to transfer and the other forces transfer better without a medium. The question is –why is there non-uniformity in force transfer? Based on the fundamental definitions of the entities in Vedic Cosmology this author has understood that **all forces need a medium to transfer whether it is an electromagnetic force, a gravitational force or a mechanical force created by sound waves**. This point is elaborated upon in Chapter 9; here it would suffice to say that in the Vedic perspective there is no such thing as vacuum. The so-called vacuum of space is also filled with the undetectable all-pervading most fundamental particle-field of *Aapah* that serves as a medium for the electro-magnetic and the gravitational forces. All

forces create compression waves in the *Aapah*-field to transfer just like the sound waves create compression waves in air to transfer.

Irrespective of how one looks at it the philosophy continues to follow in the proximity of physics to raise questions –

(1). *"How does one explain why the modern quantum mechanics arrived at three fundamental particles (quarks) forming a stable nuclear particle which is similar to the fundamental definition of matter in the Vedas- the triplet of sata-raja-tama?"*

(2). "*What properties or mechanisms in the Big Bang create four forces?"*

(3). "*Why are there four fundamental forces in Nature, why not just one or five? What led to this optimal balance in the count?"*

A fundamental force between the fundamental particles manifests as a property of matter when matter manifests from the undefined state in the Planck Era into a defined state later. The inert matter being the follower of the physical laws it does not have a property or a law unto itself to create the four physical laws and to impose them back on to itself. So, more questions arise:

(4). *"Does the fundamental particle create itself and the property of force within itself, or did the matter and force co-create fundamental partcle"? Which is the 'cause' and which is the'effect'? Why do the fundamental forces not have their own evolutionary history leading to their most accurate present finalized state?"*

What all takes place in the tiny universe right after t = 0 sec to t = $10^{-43}$ sec in the Planck Era is still being understood in theoretical physics. The small Planck-time is an extremely small time, yet it is mathematically important and it is this time interval that determines the future of the universe in terms of the nature of matter itself and the final shape of the universe. This small time sector in Big Bang is still a sort of missing link not understood fully like the missing link in Darwinian evolution. In this margin of time the Strings Theory of the universe is also invoked. In the Strings approach the attempt is to bring together the Quantum Mechanics and

General Relativity to develop Quantum Theory of Gravity which then may be able to tell the whole story of the creation of the universe from t = 0 seconds onwards.

We are familiar with the three dimensions in geometry to which the fourth dimension 'time' was added by Einstein in his Theory of Relativity. The Strings Theory works with a total of 11 dimensions and predicts multiverses - the existence of many universes other than ours. No one has seen these dimensions of Strings Theory and no one can prove or disprove them. Therefore some physicists have started to rethink the validity of this whole concept.

The Big Bang Hypothesis faced the limitation that the General Relativity could only be applied to the well-defined matter in the form of mass, energy and the gravitational force that is exerted by the mass in matter. Going back in time to find out how and when it all got triggered, the General Relativity extrapolates the Big Bang Hypothesis towards t = 0 sec and leaves it at the doorstep of Planck-regime because what worked in the Planck regime is the Quantum Mechanics and not the General Relativity. Also, a relationship between Quantum Mechanics and Gravitational Mechanics has not been established yet. The physicists in Quantum Mechanics and quantum gravity have been hard at work for decades to develop a Unified Field Theory to reconcile the two and expect to explain everything about the universe from t = 0 sec onwards revealing the fundamental nature of matter as well. A connotation for this expected unifying theory in literature is the "Theory of Every Thing".

Since there has not been success in unifying all forces the aspersions are being cast on the validity of the mathematical singularity of Big Bang itself. In the Big Bang singularity the temperature of the singularity is infinitely high and its mass (energy) is also infinitely great which violates general relativity and common sense that one derives from the observed universe. Temperature is the inherent nature of matter and energy. If there is temperature in the Big Bang singularity there must be matter in that singularity. Dealing in Quantum Mechanics one could create enough matter invoking vacuum fluctuations to create a universe. The problem in this process is that an equal amount of anti-matter is also created. Then the question is – what do you do with it? Create an anti-universe, and where to put it? For a general reader it would be mind-boggling, to say the least, and it also defies the cause-and-effect principle which prevails in the inheritance

of the human mind that something is created out of something and nothingness cannot be the cause of something. A pigeon appearing out of nothing from a magician's hat even is owing to the reality that magician and the pigeon have preexistence.

In the literature on cosmology, the state of matter during Planck-time or the state at t = 0 sec has no specific name that would represent its nature or properties. It is generally referred to as matter and/or anti-matter, which spontaneously appear and disappear in empty space. Although the Veda mantra does not stipulate the time duration of an epoch or the mass of matter, the state of matter at that time, as mentioned earlier, is assigned a meaningful term, the *Asata*-state (RigVeda, 10/129/1). In the Vedas and Vedic Literature the descriptive adjective for this state of matter is *avyakta*, which in English is 'indescribable' or 'indefinable' or 'inexplicable'. From the modern physics one learns that the matter in its real existence during the creation phase exists in full-fledged diversity, with Hydrogen, oxygen, iron, gold, compounds and substances, which in the *Asata*-state of dissolution precipitate into the indefinable uniformly mixed three forms of inactive *aapah* particles, *sata*, *raja* and *tama* with complete absence of any dynamic activity. Therefore, as discussed in the Vedic Cosmology Scenario in Chapters 7, the Vedic universe begins with cold matter without any temperature in it. The *Asata*-state in Vedic cosmology transits into *Sata*-state at t = 0 sec of the Vedic Big Bang and remains in the *Sata*-state during the whole creation till the Big Crunch when the matter returns into the *Asata*-state again. The Big Crunch of the Vedic cosmology is however different from that postulated by the Big Bang Theory. This difference will be elaborated up on in Chapter 10, Volume 2).

**Table 2.1a : Expanding universe t = 0 sec to 13.8 billion years.**

| Era (Epoch) | Duration from t= 0 sec | Size of Univ. (radius) | Temp. |
|---|---|---|---|
| Planck | 0 to $10^{-43}$ sec | $10^{-35}$ m | $10^{32}$ $^{o}$K |
| Cosmic Inflation | $10^{-36}$ to $10^{-32}$ | 1 m | $10^{27}$ |

| | | | |
|---|---|---|---|
| | **sec** | | **$^{o}$K** |
| **Quark-Lepton** | **$10^{-32}$ sec to 10 sec** | **$4x10^{13}$ km** | **$5x10^{9}$ $^{o}$K** |
| **Radiation** | **100 sec to 3000 Yrs** | **$5x10^{14}$ km** | **$10^{9}$ $^{o}$K to 60,000 $^{o}$K** |
| **Matter** | **3000 Yrs onwards to present 13.8 BY** | **$3.4x10^{23}$km** | **2.7 $^{o}$K** |

The universe according to the Big Bang Hypothesis goes through different epochs of time that cosmologists have named on the basis of what went on in that epoch. Without going into the details of the epochs their salient features are listed in Table 2.1a. One finds in the Big Bang literature a considerable variation in the numbers associated with the epochs, however, the numbers in the Table 2.1a represent more or less a realistic picture of the progress in the Big Bang physics.

When the universe was only $10^{-36}$ sec old and less than a meter in radius, it was subjected to sudden exponential expansion by a factor of trillion-trillion-trillion. This mechanism is termed as the Cosmic Inflation. The particle physicist and cosmologist Alan Harvey Guth of Harvard University introduced in 1980 the idea of Cosmic Inflation in the Big Bang Hypothesis. There is no provable physics reason for this sudden Cosmic Inflation occurring only once in the universe's lifetime, cramped in a negligibly small time span between the Planck and the Quark-Lepton eras and violating some well-known physics rules. Such an expansion in such a short time-duration does not ever occur again in the created universe. It is not even close to a physical phenomenon that one can observe anywhere in the universe or create in a physics laboratory. The only reason for this imaginary exercise is that this shock-treatment to the universe makes the Big Bang Hypothesis viable for creating a universe and explaining the phenomena and features in its present state after 13.8 BY.

The Cosmic Inflation hypothesis is doomed if the time-window is not infinitely short and specific. It is a mathematical exercise to make our universe unique. Small variations in parameters would create universes

different from ours. The specific set of critical parameters also makes the creation suitable for life to exist later when Earth-like celestial objects are born in the universe. With the other sets of parameters other universes can be created. It is these other uncountable combinations of sets of parameters creating uncountable other universes that some cosmologists think do exist outside our universe. Cosmologists insist that the process of inflation is not unique to our universe and they put it metaphorically as - our universe is like a bubble among many universes on the 'tree of bubbles' (the tree of universes).

One needs a cause for Cosmic Inflation to occur. The cause is said to be primarily the combination of two ingredients, the 'inflationary energy' and gravity. The hypothetical 'inflationary energy' has to be extremely dense such that its density during inflation does not change and the gravity should have the property of repulsion rather than attraction, which is contrary to its nature in the rest of the universe's life. It is this gravitational repulsion in the early matter of the universe, which under the high energy density in matter causes the space to expand suddenly. Additionally, the quantum fluctuations in the universe's matter within this short window in time are thought to be the cause for creating islands of matter that are the future galaxies in the later life of the universe. It is also during this time epoch that the mode of the universe is supposed to have been set to create a universe with the property of flatness. It is not that the Cosmic Inflation automatically yields a flat universe it is the arbitrary mathematical massaging of the Big Bang equations that results in a universe to match the one presently observed in astronomy. This drastic hypothetical step in Big Bang cosmology has been discussed at length in the literature on modern cosmology, however, some salient features of the 'inflation debate' are presented in the following under 'Deficiencies of Big Bang Hypothesis'.

The particles of matter, anti-matter and radiation appear after the inflation era. The universe starts with equal number of matter and anti-matter particles. After the Inflation ends and before $10^{-10}$ seconds in the life of the universe, the matter and antimatter annihilate each other giving off high energy gamma radiation and other matter and anti-matter particles. This results in a universe that is dominantly filled with radiation and matter. The Big Bang Hypothesis further suggests that for some reason more matter is created than antimatter. Quantum Physics explains this matter-antimatter

disparity; however, it does not explain why the matter should have the dual nature of matter and antimatter.

When the universe is only a few meters in diameter, still within a tiny fraction of time, it is filled with a hot dense soup of quarks and leptons. Negatively charged electrons belong to the lepton category and are found free as well as in the bound state. Quarks are not found free in the universe because they all are quickly consumed into the next stage of particles called hedrons. There are two types of hedrons: baryons and mesons. A baryon is formed of three quarks. A meson is formed out of a quark and an anti-quark. It is the baryons that form the nucleus of an atom. This era of the formation of baryons is also known as the Baryogenesis Era when most fundamental forms of matter start to form which then become the main cause for the formation of the observable universe.

The temperature drops to $10^{10}$ ºK about 1 second after the Big Bang and the homogeneous sphere of the primordial matter is about $4x10^{10}$ km across. At 100 sec when the temperature of the universe is about $10^9$ ºK (1 billion $^{o}$K) the nucleo-synthesis begins forming Hydrogen and Helium atoms, ending up with about one-quarter Helium and three-quarters of Hydrogen by mass. The matter density at the end of this time period is equal to the radiation density. During the Radiation Era, the photons of light of different colours are produced including the microwave part of the spectrum. George Gamow (1904–1968), a well-known Russian-American theoretical physicist and a cosmologist, predicted from his studies of Big Bang nucleosynthesis and the stellar nucleo-synthesis that the Big Bang would produce sufficient radiation in the microwave region of the spectrum that should be observable now. Formation of neutral Hydrogen produces this radiation. This radiation is named as Cosmic Microwave Background Radiation (CMBR). This CMBR was created in all directions at every point in the universe about 379,000 years after the Big Bang. Since then the Hydrogen and Helium condensed into stars and galaxies while they were being accelerated away from each other owing to the initial momentum they acquired in the Big Bang explosion. Now they occupied the universe that was 46 light-years across ($4.35x10^{23}$ km); a light-year being the unit of distance which light covers in one year at the rate of 300,000 km/sec. Despite the expansion of the universe the CMBR was expected to retain its isotropic distribution throughout the universe's growth. This radiation was finally discovered by two American physicists from Bell Laboratories, Arno Allan Penzias (1933)

and Robert Woodrow Wilson (1936). In 1976 they were awarded a Nobel Prize for their discovery. The discovery of this 'radio remnant' of the Big Bang provided support to the Big Bang Hypothesis and helped cosmologists to improve the Big Bang Theory.

The temperature of the universe drops to 3,500 ºK when the Big Bang is about 300,000 years old. The atoms are formed, matter dominates in the universe and it becomes transparent. At the age of about 500,000 years, the matter of the universe cools further to about 3000 ºK and is about 3,000,000 light-years across ($3x10^{19}$ km). After about 100 million years to 1 billion years the stars begin to form as part of the galaxies that are now counted to be in billions. According to NASA's recent observations with the Hubble Space Telescope, there are over 150 billion galaxies in the visible universe that may contain over $7x10^{23}$ (700 thousand-million-million-million) stars. Of these stars some turn into supernovae that explode. Observation of supernovae provides considerable information on star formation.

There are about 100 billion stars within our Milky Way Galaxy, the home of our solar system. Our solar system was formed about 5 BY ago and our Earth within it was formed about 4.6 billion years ago. The Canadian scientists of the University of McGill in Montreal in 2008 discovered the oldest rocks on the Earth that are at least 4.28 BY old and are considered to be the remnants of the formation of the first primordial crust on our planet. The first life on Earth according to modern biology appeared some 4 billion years ago when a living cell acquired the nature of a 'replicator' to produce one more of its kind. The process continued to evolve producing bigger conglomerates of such cells ultimately forming bodies of living beings. This is how modern biology, more or less, hypothesizes about the beginning of life on the Earth.

The matter of the universe now in the form of stars and galaxies is still flying out at great speeds. The observations of these cosmological objects provide an estimate of how long ago the Big Bang took place and how far the material of the universe has reached. The present age of the universe is about 13.8 BY. This age of the universe is based on what has been observed thus far with the upper limit of the sensitivity of the instruments in astronomy. The universe certainly is beyond that limit. The diameter of the universe that we see around us within the perception of our best observing instruments is at least 93 billion light-years wide. Thus, the present observable universe is about $8.8x10^{23}$ km across and continues to expand.

The open literature on the Big Bang has pictorially delineated the process of Big Bang with differing emphases that a reader can benefit from.

## Endowment of Big Bang Creation

In the present universe there are a large number of inherent forms of matter and energy and the laws of Nature to govern them. These different forms under the laws of Nature exhibit specific characteristics that are seen in the form of motion and change of state. Only the important ones with their broad definitions and descriptions are included here. As new theories and measurements become available the information on the subject of cosmology continues to change. A brief commentary on the matter, energy and shape of the universe is presented in the following.

# Observable Matter

Observable matter is the part of the universe that interacts with electromagnetic radiation, latter in its visible part of the spectrum is termed as light. Atoms and molecules interact with radiation through absorption and reemission. The process of reemission also includes reflection of light that makes the atoms and molecules visible. The observable matter is termed as 'baryonic matter' because the fundamental particles forming the nuclei of atoms are named as baryons (proton, neutron). It was mentioned earlier that right after the onset of the Big Bang, the matter of the universe goes through transitions from undefined state to definable state when matter particles called quarks first appear. A neutron or a proton formed out of three quarks each weighs about $1.7 \times 10^{-27}$ kg. The other kind of prevalent charged particles, also formed in the early stages of Big Bang, are electrons. An electron is negatively charged and weighs only $9.1 \times 10^{-31}$ kg ($1{,}868^{th}$ of a proton). For a general reader it should suffice to say that because the opposite charges attract each other, a proton captures an electron to form a nucleus of a stable atom of Hydrogen (chemical symbol H). Hydrogen atom is the first created lightest element in the universe (Figure 2.2). The captured electron does not just go and stick to a proton; rather it goes into an orbit around the proton under the influence of the electro-static force of a positively charged proton. This is something similar to the Earth, with a mass $330{,}000^{th}$ of the Sun, orbits around the Sun under the Sun's gravitational attraction on the Earth. In a classical sense the electron is orbiting around the proton (nucleus) at a very high speed of over 2 million meters per second just like the Earth goes around the Sun, although considerably slower; only about 30,000 meters per second. The diameter of the Hydrogen atom including the orbit of its electron is $10^{-10}$ meters (ten-billionth of a meter). The diameter of a proton alone being $10^{-15}$ meters (one thousandth of a trillion meters) is therefore 100,000 times smaller than the Hydrogen atom itself.

The differing number of nuclear particles in a nucleus of an atom makes one atom different from the other and heavier than the other. The next heavier atom formed in nature is Helium (He) which has two protons and two neutrons in its nucleus with two electrons orbiting around it. The

number of protons in an atom determines its atomic weight. After H and He with atomic weights of 1 and 2 respectively, heavier elements right up to radioactive Uranium with atomic weight of 92 are formed at a later stage of creation of the universe. About 75% of the mass of the universe is in Hydrogen, about less than 15% in He and the rest of the heavier atoms are proportionately less abundant in the universe.

A multi-atom unit of an element is known as the molecule of that element. The nature presents itself in the form of a large number of chemical compounds that are used by nature to reveal itself in the form of conglomerates much larger than single atoms, conglomerates ranging from the bodies of living-beings to the solar system, the galaxies and so on. It is the matter of the universe that reveals the universe itself to our eyes which receive light coming from the objects of the universe. The light is also a state of matter that reveals other forms and states of matter. Light is energy. Matter and energy go hand in hand in revealing the Nature. Matter is found in three major states; solid, liquid and gas, the latter not being observable owing to its molecules separated from each other. The air, a mixture of molecules of nitrogen, oxygen and other gases, is thus invisible to the eye.

The night-sky, lit up with the stars gives an overwhelming impression of abundance in nature. When the size of the observable universe is considered and the observable matter in it, in the form of free Hydrogen, Helium, other atoms and molecules and galaxies are accounted for, one feels that this resplendent universe is packed with matter. This however is a mere 'optical illusion'. The universe in fact is quite a rarified entity and fits the definition of a vacuum. The stars in individual galaxies and individual galaxies themselves are far apart from each other with large expanses of the void of space separating them.

If the total observable matter of the universe is accounted for and total volume of the observable universe is determined the matter density of the universe can be determined. The density of a substance is measured by finding how much substance is present in a unit volume occupied by that substance. For example, a volume of water 1 cm by 1 cm by 1 cm (1 $cm^3$) weighs 1 gram. Therefore, the density of water is 1 gram per centimeter-cube (1 $g/cm^3$). Cosmologists provide differing estimates for the overall density of matter in the observable universe; however, compared to the water density of 1 $g/cm^3$, an acceptable rough estimate for the density of the universe as a whole is only $3x10^{-31}$ $g/cm^3$ This suggests that the space of

the universe with all that matter in it on an average is a vacuum. This value of the universe's density is 100 billionths below the attainable vacuum in the laboratory. This density of universe is equivalent to finding one Hydrogen atom in a 2 meter-cube of space. Of the total matter-energy balance of the universe the observable matter forms only 4%; the rest being in the form of energy. Although we see clumps of matter in the form of stars and galaxies, the universe on large scales, on an average, is considered to be homogeneous with uniform structure throughout and isotropic with uniform density in all directions, fulfilling the condition of the second Cosmological Principle listed earlier.

# Dark Matter and Dark Matter Mystery

In addition to the observable matter, which is a reality of the universe, cosmologists have hypothesized the presence of another kind of matter that is not seen or measured directly. It is thought to have mass causing gravitational effect on the observable matter. It is popularly known as the 'missing matter' of the universe and cosmologists also address it as the 'Dark Matter'. In 1933, Fritz Zwicky of the California Institute of Technology studied the Coma cluster of galaxies and found that its total mass based on its total brightness was several orders of magnitude higher than the estimate based on the number of galaxies near its edge. This discrepancy between the estimated and observed mass could be explained if there was more mass there than observed. This led to the idea of the 'missing matter' or the 'Dark Matter' of the universe.

In 1975 Vera Rubin and Kent Ford from Carnegie Institute of Washington presented their discovery at the American Astronomical Society that most of the stars in spiral galaxies orbit around the galactic centre with about the same speed; contrary to the expectation that the outer stars should orbit slower in the same way as objects of our solar system where outer planets have longer orbital periods. This was thought as a confirmation for the presence of more matter in the galaxy than was observed because without it the outer stars would fly away from the galaxy. It was the invisible Dark Matter which was at least half of the total galactic mass and seen as a dark halo around the galaxies. The rotational and orbital speeds in galaxies and several other phenomena associated with the observable part of the universe are attributed to the gravitational influence of this hypothetical invisible matter. It forms about 27% of the total matter-energy equation of the universe.

What is Dark Matter made of? The answer to this question at present is speculative. Since its observed property is gravitation and it being non-interactive with the radiation, the most entertained hypotheses for its origin are those suggesting its makeup from non-baryonic particles (i.e. no protons, neutrons)

The Chapter 8 presents several mysterious Vedic mantras (AtharvaVeda, 10/8/7, 13) that state by asking a question first that the

cosmos are formed out of half the mass of the universe then where is the other half? In these mantras the expression such as अर्धेन विश्वं भुवनं… (*ardhen vishvam bhuvanam…*), meaning – "*From the half is created the entire cosmos…*" and सप्तार्द्धगर्भा भुवनस्य रेतो… (*saptaarth-garbhaa bhuvanasya reto…*) meaning – *"Those seven born out of half the embryo, the primordial matter, are the first matter-seed of the universe…"* have considerable cosmology hidden in them that is revealed in Chapter 8. The answer comes in the other mantra (RigVeda, 1/164/36) that the other half is used up right in the beginning of the creation to create seven *Deva* energy fields that advance further the creation of the universe. These mantras are discussed in detail with word translation under the sub-heading of "Matter distribution between *Devas* and Observable Universe" in Chapter 8. Not just the matter of the universe but they assign a proportion of 50% to what is being observed as the observable universe with the other 50% being invisible.

In the context of cosmology, the invisible other half of the total mass of the universe in the Vedic mantras, is either the Dark Matter of contemporary cosmology or it is the regular matter beyond our observable limit of the universe. Nevertheless when a mantra assigns a hard number to the matter of the universe, one ought to take notice of it. It is also discussed in Chapter 9 that the third component of the *Aapah* triplet designated as the *tamah-aapah* (dark-*aapah*), which is the fundamental state of matter, in this author's thinking, is universally distributed and serves as the invisible and undetectable 'viscosity of the space' that moderates the speed of objects in space. This author also surmises that it is this ubiquitous *tamah-aapah* (also means dark), that sets the limit on the speed of light $3x10^8$ meter/sec. The Vedic perspective of this invisible *tamah-aapah* serving as the 'viscosity of Space is further discussed in Chapter 9.

The physicists accept that the Dark Matter exists and plays an important role exerting its gravitational force on the matter of the universe. They are hard at work to understand what Dark Matter is, how was it created, when was it created or as the Veda suggested - was it always there as the $1/3^{rd}$ of the "material-cause" of the universe called the *tama-aapah*? As discussed in Chapter 5 in Volume 1 and Chapter 9 of Volume 2 that in the Vedic physics the most fundamental particles are a trio of *sata, raja* and *tama*; the *tama* being the most inactive.

With regard to the present understanding of the Dark Matter, Prof. Dan Hooper of Fermilab, Chicago University, summarized in an article in the "New Scientist", Vol 244, No. 3256, 16 November 2019 as:

"*…. the stubborn illusiveness of dark matter has left many physicists and cosmologists surprised and confused. In droves, we are returning to our chalkboards, revisiting and revising our assumptions – and with bruised egos and a bit more humility, desperately attempting to find new ways to make sense of a very dark and hidden universe.*"

The Vedic ideas may provide some possibilities!

# Energy

The universe is more energy than mass. Although there is equivalence between mass and energy through Einstein's equation ($E = mc^2$), the difference in mass and energy is that mass exhibits weight and energy is treated as a mass-less commodity. Most common energy is in the form of electro-magnetic radiation covering a wide spectrum from short wavelength radiation in the form of X-rays to long wavelength radiation in the microwave region. The radiational energy in the infrared region of the spectrum between visible and microwave is commonly known as the heat energy.

Optical telescopes are utilized to image and measure the stars and galaxies. The microwave radio telescopes are utilized to measure microwave radiation. The stars and galaxies are also imaged in this part of the spectrum. As mentioned before, a homogeneous permanent energy feature of the universe is the CMBR. This low level radiation uniformly coming from all direction is also measured with high sensitivity microwave radio telescopes.

Because a force relates to energy one could perceive gravitational energy corresponding to the gravitational force. Energy is also available as kinetic energy owing to the motion of the object. It can be in the form of potential energy stored in an object against a force.

A completely different source of energy is hidden in the vegetation world. This energy is the molecular bond energy that is consumable by living-beings. These different forms of energies are observable through the effects they create. They are measurable and harnessable for practical use. In the Big Bang cosmology there is yet another energy of mysterious nature that is said to be permeating through the space of the universe but is not harnessable for practical use like the other forms of energies. It is the Dark Energy, also addressed as the Vacuum Energy.

## Dark Energy / Vacuum Energy

It is suggested in Big Bang Hypothesis that the gravitational attraction between the galaxies tending to pull galaxies inwards opposing the expansion of the universe, should ultimately slow the expansion of the universe down and finally bring all galaxies closer together. In this scenario the universe collapses into one mass, returning back to space-time singularity where it all began. The logic prevails that if the Big Bang explosion created the universe sending matter to far distances the reverse process of collapsing the universe under gravity should send matter to the condition it was in the Big Bang singularity. This means that all matter of the universe must come together and disappear into one dimension-less point of space where Space, a real entity holding the universe, must also disappear into nothing. However, what one observes presently is that the universe is expanding at an accelerated rate. The observations of a very distant supernova in 1998 by Hubble Space Telescope showed that when the supernovae had exploded when the universe was only about half its age, the universe was expanding at a much slower rate than now. Presently the universe is said to be expanding at an alarming rate with the farthest observed galaxies seen flying out with the highest acceleration. The astrophysicists express this unusual expansion as the 'cosmic acceleration'. This would happen when some additional force/energy was acting against the gravitational force due to the mass of the universe. For such energy to expand the universe in all places and in all directions, it has to permeate throughout the space of the universe. Not knowing what this energy is, the cosmologists have called it the Dark Energy.

A steady-state universe, as Einstein had first conceived, would not collapse on itself due to its own gravitation. He modified his field equations in General Relativity by introducing a constant called the 'cosmological constant', represented by the Greek letter lambda $\Lambda$. To oppose the action of Newton's gravitation constant G in his equation that represents gravitational force, Einstein introduced the positive constant $\Lambda$ (with other necessary parameters) on the other side of the equal sign of the equation. Just as the matter contributes to the gravitational field which pulls matter inward, Georges Lemaître in 1934 related Einstein's cosmological constant $\Lambda$ to a hypothetical energy named 'Vacuum Energy'. The tendency of this energy should be to push matter outward to counter the gravitational pull. The idea was that if energy exists in vacuum it must exert outward pressure to oppose the effect of gravity.

Einstein had proposed in 1917 that the vacuum of empty space is not a 'nothing'. It has properties of its own. His premise was that the cosmological constant in his equation, countering the gravitational attraction, represented the energy of the empty space and that this energy was constant and permeating throughout the universe. This energy was a property of space and it does not weaken when the universe expands because the more the universe expands, the more space is created and therefore more Dark Energy is available. Not much is known about the true nature of this mysterious energy as to what its structure is and how it interacts with matter and the other energy forms in the universe. It continues to be addressed as the Dark Energy. Also, because no new matter is created in the universe but more space is created owing to the expansion of the universe, more and more Dark Energy is created accelerating the expansion of the universe. One easy deduction from this scenario is that the universe is tending towards a Big Chill!

The question is – how does the space acquire this energy in the vacuum of the space? The existence of 'Vacuum Energy' has been observed through the manifestations of several phenomena. Owing to its presumed action this uniform background energy by definition must be all-pervading through the universe. It is said to exist in space with or without the presence of matter. Since there is equivalence in mass and energy, the Vacuum Energy is expected to exert its influence on objects of the universe through its contribution to the cosmological constant, the critical value of which would determine if the universe would expand or contract and at what rate.

The Vacuum Energy is presently thought of as a phenomenon in the realm of Quantum Mechanics, however, the mystery of the actual nature of Vacuum Energy and what creates or created it, is not understood well. The most accepted mechanism is said to be the appearance of 'virtual particles' (particle-antiparticle pair) in the vacuum of space which annihilate each other giving out a burst of radiation, resulting in increased outward pressure in the empty space causing the expansion of the universe. For Vacuum Energy to play the vital role in sustaining the expansion of the universe, it has to have its right proportion in the total mass/energy equation of the universe. Because the universe is said to be expanding at an accelerated rate than what it used to be, the Vacuum Energy must have increased. The astrophysicists think that as the universe expands and more and more

vacuum in space is made available to increase the creation of the virtual particle-antiparticle pair, the pressure of the Vacuum Energy must increase.

One difficulty in accepting the hypothesis of the virtual particle-antiparticle annihilation being the source of the Vacuum Energy is the estimate of the energy itself. The error estimates by cosmologists are infinitely larger than acceptable. Therefore, the question as to how the vacuum of space gets energy remains outstanding.

The astronomical observations provide estimates of the energy density of the Dark Energy (Vacuum Energy) in terms of the mass density units to be $7x10^{-30}$ grams/cm$^3$. Although this is a negligibly small number it is a few orders of magnitude higher than the mass density of the universe, $3x10^{-31}$ grams/cm$^3$, enough to cause accelerated expansion of the universe. In proportion to the mass of the universe the estimates show that the Dark Energy is about 68.3% of the total mass-energy equation of the universe. The remaining 26.8% is the mysterious Dark Matter and 4.9% is the regular matter.

## A Vedic Perspective – No Dark Energy Needed

Astrophysicists have suggested several alternate theories for the origin/mechanism for the Dark Energy but none are considered to be fully convincing. It is often suggested now that Einstein's theory of gravity itself could be incorrect and needs a fresh look. The Vedic Creation Principle (Chapter 6) and the Vedic Creation Scenario (Chapter 9) together provide an alternative to the mysterious Dark Energy, not considered in modern cosmology yet. When it comes to cosmology, the Vedic mantras do not resort to suggesting hypothetical mechanisms or a divine intervention to explain a physical phenomenon in Nature, such as the expansion of the universe. Their premise always is that whatever has been created is real and no virtual phenomena are created by vacuum of space. The mantras do point out that the Space is stretching, the universe is expanding and the mechanism of expansion is part of the dynamics developed by the universe during its primordial stage when it was preparing for the Vedic Big Bang. In the Vedic principle for the creation of the universe, the entire mass of matter that was going to be the universe began as a conglomerate in ovate shape

named the *Hiranyagarbha* (Golden-embryo) which remained in *paryaplav*, the rotation around an axis while in floatation, for a specified period of 4.32 million years.

The Vedic term for the universe's axis of rotation is *Skambha* (the pillar of energy) which supplies energy to the entire matter of the universe. The mantra references emphasize that the *Hirnyagarbha* during this period develops tremendous *tapasah*, the heat energy and the angular momentum, supplied by the *Skambha*. Then *Hiranyagarbha* explodes in a Big Bang creating uncountable clumps of matter that form galaxies and celestial objects within them. Each celestial object of the universe, all the galaxies as groups of stars and the entire universe as a whole inherits the angular momentum from the parent *Hiranyagarbha*. The all-pervading centrifugal force of the universe owing to its inherent angular momentum causes the galaxies to fly outward expanding the universe against the inward pointing centripetal force caused by the gravitational force owing to the mass in matter.

The *gurutva* (gravitation) in matter causing contraction and the centrifugal force causing expansion strikes a dynamic balance in the rotating and expanding universe. The rotation of the universe around its *Skambha* axis which is also said to be the source of energy for the rotating universe, like a bar at the centre of a galaxy, causes the flattening of the universe. The Veda mantras point out the fact that the universe is a flattened cart-wheel like system. Modern cosmology may have a different meaning of the flatness of the universe; however, on the basis of the observations it stipulates that the universe is flat; just like what the Veda stated. For the Big Bang theory to create a flat universe the cosmologists introduced required parameters in the Cosmic Inflation.

The Vedic scenario does not need a hypothetical Dark Energy and all the related hypotheses to go with it. The physical action of rotation and the accompanying centrifugal force are real phenomenon. To explore the Vedic possibility in modern cosmology one has to set up the momentum equations within the gravitational consideration and determine the rate of expansion of the universe. Once considered the Vedic expansion mechanism due to the rotation of the universe, as discussed in Chapter 9, the expansion of the rotating universe may not even be as much as suggested by the astrophysicists because the part of the observed red-shift in the spectrum of the faraway galaxies could just be an artifact of space-time geometry in a

spinning universe. Also, because the Space-entity according to its Vedic concept acts only as a non-reactive provider of a home for all the substances of the universe and therefore serves as the container of the objects of the universe, it does not have the property of creating energy through virtual particles. Therefore, yes Einstein's theory needs a fresh look. A detailed discussion on this subject is included in Chapter 9.

# Deficiencies in Big Bang Hypothesis

A large number of astrophysicists, cosmologists and astronomers adhere to the most acceptable Big Bang Hypothesis and carry out research to learn more about the universe. Many of them have used space-based Hubble Telescope and other satellite data to substantiate their previous findings and have reported new findings to support this hypothesis. There is however the other side to this coin. There have been a large number of dissenters of this hypothesis, included among them are well-known astrophysicists, cosmologists and astronomers. The list includes some of the well-known physics personalities such as Sir Fred Hoyle, the Nobel Prize winner Hannes Alfven, astronomers Geoffrey Burbidge, Halton Arp and some thirty other scientists who signed a joint dissent letter, published in a weekly British science magazine, the New Scientist. Over 500 more have signed-in since then (New Scientist, May 22, 2004). The list of dissenters includes scientists and engineers from famous academic institutions around the world. The interested readers may dig into this controversy by accessing considerable literature on web sites. Examples of such references are: "The Top 30 Problems with the Big Bang" by Tom Van Flandern of Meta Research; "The Big Bang Theory under Fire" by William C. Mitchell (Phys. Essays Vol.10, 2, June 1997) and more.

There are scientists who are hundred percent confident about the soundness of the Big Bang Hypothesis. Others having no better alternative carry on their research within its framework. Then there are some who have spent over two decades working with the Big Bang Hypothesis, Cosmic Inflation mechanism included, who now have started doubting its foundations and are looking for improvements in the Big Bang Theory itself or even looking for other alternatives. The most fundamental reason for this awakening in cosmology since Guth introduced the idea of Cosmic Inflation in 1980 is that it created more questions than it answered and it created more doubts than it alleviated. In an article (Scientific American, April, 2011), Paul J. Steinhardt, one of the theory's creators, the Director of Princeton Centre for Theoretical Science at Princeton University in USA said:

"*Matching experiments trumps any theoretical argument. But the strange twist to this story is that the predictions of the early 1980s were based on a naïve understanding of how inflation actually works - a picture that has turned out to be dead wrong*".

To get around this naïve understanding the Big Bang cosmologists came up with a new picture of the Big Bang. This new picture included eternity of inflation in islands of space, each representing a different universe. This led to the Multiple Universe Hypothesis with inflation still a continuing theme in the Big Bang Hypothesis. If all such universes outside our own and non-provable use Cosmic Inflation, they have not been free from the *naïve inflation*. From the perspective of the Anthropic Principle it is beginning to look as if the cosmologists are going out of our universe to win an argument!

Continuing with Cosmic Inflation in a non-naïve way with more assumptions and with different mathematics seems to be the solution for graduating the naïve Big Bang to a new acceptable level. However, creating an infinite number of universes outside ours using eternally going inflation hardly changes the argument because if one can create a universe with inflation one can create many universes with inflation. So why go to another universe to prove that the Cosmic Inflation occurred in our universe? This does not prove anything! The article by Steinhardt has presented a good overview of the problems with inflationary Big Bang and has brought in the views in favour of and against the Big Bang Hypothesis. Steinhardt's article summarized quite eloquently under the sub-title "IN BRIEF" thus:

"*Cosmic Inflation is so widely accepted that it is often taken as established fact. The idea is that the geometry and uniformity of the cosmos were established during an intense early growth spurt. But some of the theory's creators, including the author (Steinhardt), are having second thoughts. As the original theory has developed, cracks have appeared in its logical foundations. High improbable conditions are required to start inflation. Worse, inflation goes on eternally, producing infinitely many outcomes, so the theory makes no firm observational predictions. Scientists debate among (and within) themselves whether these troubles are teething pains or signs of a*

*deeper rot. Various proposals are circulating for ways to fix inflation or replace it"*.

The cracks in the theory or possibility of deeper rot in it felt after two decades are owing to the powerful human psychological phenomenon that pervades through conscious-beings. This phenomenon, briefly discussed in Chapter 1, is addressed in Vedic terminology as *sanshaya*, which is 'doubt' of a substance (entity). The brief discussion on *sanshaya* (doubt) in Chapter 1 was with reference to the *sutra* (2/2/17) formulated by the pre-Mahabharata Vedic philosopher Rishi Kanaad. Several *sutras* later Rishi Kanaad stated that '*vidyavidyatashcha sanshayah* (2/2/20)', which translates into – "*Sanshaya* (doubt pertaining a substance) *is created by both, the knowledge as well as the non-knowledge (ignorance) about the substance*". This means that complete knowledge of a substance uproots doubt about the substance and complete ignorance about a substance does not create any doubt about the substance. For example, a galaxy far away that has never been seen and is beyond astronomical observation cannot create doubt about it. In the present context the primary 'substance' is the universe itself and we have incomplete knowledge about it. Therefore, the universe ought to create *sanshaya* (doubt). The Big Bang Hypothesis not being able to create complete knowledge of the universe is not free of *sanshaya* (doubt). Therefore, the Big Bang Hypothesis is the source of knowledge as well as the source of doubt (ignorance) as stated by Steinhardt, cited above, "…*cracks have appeared in its logical foundations*….". The *sanshaya* is a discontinuity in the thread of knowledge. From Rishi Kanaad's *sutras* one can safely deduce that '*complete knowledge of the properties of the substance* (or of something), *completely neutralizes doubt about the substance'*. The big Bang Hypothesis is deep in *sanshaya*.

To remove newly created 'doubt' about the universe one has to first have a complete grasp of its ordinary properties and then extend the effort to gather its extraordinary properties such as how big it is, when was it born, is this a pure physical system or a combination of matter and consciousness. This obviously leads to developing of theories that should reveal its prodigious properties. The whole effort is to remove doubt about the universe by predicting and proving all its properties. In the process of un-knotting the thread of knowledge if more knots accrued, the likely-hood

is that the process did not have a good start. A new approach altogether is becoming a necessity to reveal the universe's prodigious properties.

A few important features of the Big Bang Hypothesis are discussed in the following which are the cause for doubts and controversies.

# Horizon Problem and Cosmic Inflation

It was mentioned above that the Cosmic Microwave Background Radiation (CMBR) is observed to be extremely uniform from all directions in the sky. This suggests that the universe is homogeneous in all directions and is also thermally uniform corresponding to a CMBR temperature at 2.735 ºK (-270.265 ºC). After the CMBR discovery, a question was raised in the early 1970s - why is the universe so homogeneous with a constant temperature in all its regions, when these regions are so far apart now that even light would not have reached from one to the other in its life history of 13.8 BY? To explain what this means, several similes have been used in the Big Bang literature; the heater in a room is one. It takes some time for the heat to transfer from one end of the room to the other and it takes even longer for the entire room to come to the same uniform temperature. When this occurs, we say that there is a causal connection between the heater, the air in the room and all sections of the room. But such a causal relationship is not expected in the case of the universe which is so large that heat (CMBR) could not have reached from one end to the other in the life of the universe 13.8 BY. However, the uniformity in observed CMBR exhibited a causal connection between all parts of the universe. That the entire universe must have acquired homogeneity so early in its life is also known as the 'Horizon Problem' in the Big Bang Theory. This led to the doubts about the validity of the Big Bang Theory as it stood at the time. The expected solution to this problem was suggested – that the homogeneity in the universe must have started right in the Big Bang when the universe was small. This necessitated some tweaking in the Big Bang Theory itself. This led Alan Harvey Guth in 1980 to the idea of the Cosmic Inflation, suggesting that the early universe right after Planck Time, from $10^{-43}$ sec till $10^{-32}$ sec was dominated by a 'False Vacuum'. The concept of 'False Vacuum' suggests that at extreme densities of matter, as in a singularity, the matter instead of having gravitational attraction starts to have strong repulsion.

In a recent article on the PBS website, entitled "An Eternity of Bubbles", Allan Guth has explained the mechanism of Cosmic Inflation in simpler terms. In this exponential swelling of the universe it doubled in size at every step of $10^{-37}$ second. It kept doubling at each step of this time till

the repulsion due to False Vacuum lasted. It seems that it lasted only between $10^{-43}$ sec to $10^{-32}$ sec, increasing the size of the universe by a factor of about $10^{32}$ (32 zeros after one). The False Vacuum is said to be unstable and decayed fast 'converting its energy to a hot soup of ordinary particles'. After this little blip in time the hot Big Bang mechanism carried on with the universe expanding normally. Cosmic Inflation was not necessary right after Planck Era but if it was inserted the homogeneity of the universe with the same temperature everywhere was explained and also explained then was the same intensity of CMBR in all directions. This was the arbitrary rationale for introducing 'Cosmic Inflation'.

After introducing 'Cosmic Inflation' in the theory, one had to be imaginative enough to move towards proving other future phenomena in the functioning universe. For example how the future gigantic galaxies were to be formed was to be taken care of within Cosmic Inflation epoch. This is done by theoretically creating fluctuations in matter such that the centers of the galaxies are predetermined as the nodes in fluctuations where the future galaxies would collect matter from their surrounding space. The seeds of billions of galaxies were to be separately placed when the universe was not even a meter across. If the universe created homogeneous CMBR, 379,000 years after the start of Big Bang, when the universe was about trillion-trillion km across, the Big Bang cosmologists should have no reason to think that the universe was homogeneous right from the beginning.

The doubt about the Cosmic Inflation was – what was the source of this high False Vacuum that has an opposite nature to gravitational attraction or is it just the nature of matter right after the singularity breaks? We understand that two positive or two negative charges repel each other. But this is not said to be the case in the primordial state of matter in the Planck-time regime. We also know that the gravitation and strong nuclear forces exhibit forces of attraction between matter and matter. Then it is not clear what exactly the nature of this False Vacuum is. In other words, why does the primordial matter of the universe have a repulsive property, only momentarily, only once in its life when it is at an infinitely high density? The high density in the first place is due to the property of attraction. Physicists, keeping an eye on the reality of the universe, ought to shed some light on why a tiny volume of matter for only the trillion-trillion-trillionth of a second switches its nature of attraction to repulsion and then back to attraction? Is the False Vacuum for real?

In a symmetric explosion in space, like a fire-cracker exploding up in the sky, the fragments generally fly out occupying a spherical volume around the centre of the explosion. The astronomical observations of the universe reveal that the universe is not a spherical shell like a soap bubble; rather it has uniform matter density throughout. The cosmologists call such a universe as a 'flat' universe wherein there is no space-warping and inhomogeneity. To explain this observed situation, the Big Bang cosmologists insist that the Big Bang explosion was not a usual explosion. The Big Bang cosmologists attribute flatness of the universe to the mechanism of Cosmic Inflation wherein the expanding matter of the universe assumes a mode that yields a flat universe. In the Vedic scenario on the other hand, discussed briefly above and in detail in Chapter 9, the rotation of the universe around an axis, in addition to the expansion of the universe owing to the centrifugal force of rotation, flattens the entire geometry of the universe in its outside dimensions – a wheel-like shape. The flatness of the universe has a different definition in modern cosmology.

Although the Cosmic Inflation theory is unverifiable, it was further developed by other cosmologists and has been accepted as a virtual tool to explain the problems in the Big Bang Theory. The size of the universe at the end of the inflation was only a few meters across. Therefore the Big Bang cosmologists concluded that this was the time when the universe that we observe today was causally connected and acquired its homogeneity that persisted for the rest of its life. The inflation theory also suggested that the CMBR has had close connection with the whole matter of the universe from the time the CMBR was produced.

It is the Cosmic Inflation era from where the matter of the universe transits from the Quantum Physics regime where one set of physics rules applied to the Relativistic Physics regime where another set of physics rules apply with no relation between the two sets of laws. From what this author gathers from the open literature, presently there is no specific Quantum Physics mechanism to support Cosmic Inflation. The Relativistic Mechanics applies to the universe that had already come out of the Cosmic Inflation with all the seeds of all the important observed features of the later universe already planted in it. This means that, before it enters into the general physics regime, the universe's behaviour for the rest of its life is predetermined in the Quantum Physics regime. On the basis of Quantum Physics alone, with the Uncertainty Principle being its important pillar, it is

not possible that the universe in that early state would be homogeneous with the same properties everywhere. The Quantum Physics should randomize rather than create a homogeneous universe. It is counter intuitive to think that a condition of homogeneity is a result of a turbulent explosion.

There is another twist to CMBR radiation. Some scientists think that the CMBR that is measured now may have another source and a simpler explanation for its origin. Before Penzias (1933) and Wilson (1936) discovered CMBR, Sir Arthur Eddington in 1926 had calculated the minimum temperature that a body in space attains when illuminated by just the starlight. His calculation yielded this temperature to be 2.8°K which is very close to the observed temperature 2.735 ºK corresponding to the CMBR. It certainly raises questions about Cosmic Inflation being responsible for carrying out the process of homogenizing the early universe.

## Multi-Universes – the Eternity of Bubbles

The False Vacuum is worked into the Big Bang Hypothesis to explain homogeneity of CMBR and therefore of the universe itself and it is also said that it is an unstable entity (see Guth's article, "An Eternity of Bubbles', on PBS website). The physics question therefore is - would the unstable nature of the False Vacuum not introduce instability in a homogeneous substance embedded in it, the substance being the early universe? On one hand the homogeneity in CMBR is extremely high with a measurement accuracy of 1/100,000 (one in one hundred thousand) and on the other hand it has come out of the unstable False Vacuum energy. This sounds counter-intuitive and does not seem commensurate with the physics laws that we observe in a functioning universe. In Guth's article the suggestion is that the False Vacuum energy never disappeared; rather its pieces randomly decayed to create new "bubble" universes at an ever-increasing rate. When the False Vacuum energy breaks into pieces to create new "bubbles", all bubbles being different they create all universes different from each other. Also there is no physics law or logic to create all universes homogeneous from a very unstable entity, the False Vacuum. If the False Vacuum continues to break into smaller pieces, what stops them to break into each other to create smaller universes within bigger universes? We do not see a smaller universe within our, expanding in our direction. Then no

common physics logic should suggest that the bubble that created our universe has to be highly homogeneous within itself.

Our universe is said to be just one of the universes on this infinite tree of bubbles. Guth also says that if inflationary theory is right the universe is far larger and much older than was thought and that it includes not just one but infinity of Big Bangs creating an 'eternity of bubbles'. This has led to the Multiverse Cosmology wherein mathematical experiments are performed to create a universe that certainly would be different from ours because to create our universe only one critical-valued set of parameters was required. Ours therefore is a unique universe. The critical set of parameters, also called as the fundamental constants of physics, are so fine-tuned for our universe that without them being so, the universe would not produce life on Earth as well as in other places of our universe. This is also why our universe is unique. This uniqueness is the subject of the Anthropic Principle listed earlier among the cosmology principles and is taken up in another text. As far as the Multiverse Hypothesis is concerned, it remains an un-provable hypothesis that continues to engage in creating universes outside ours that cannot be proven by observations.

If the term 'bubbles' in Guth's metaphor of 'eternity of bubbles' is replaced by the term 'tortoises', the new metaphor would be 'eternity of tortoises'! With that said it sounds like the story of the 'little lady' in Hawking's book when she had a disagreement with the famous British scientist and emphasized that the Earth was supported on the back of a tortoise and that it was tortoises all the way, each supporting the one before it! The difference between Guth's metaphor of the 'eternity of bubbles' and the metaphor of the 'eternity of tortoises' is that one is wrapped in mathematical garb and the other is not and one crosses the boundaries of the universe and the other is limited to the Earth, the latter disprovable by observations and the former un-provable, yet both are based on counting the numeric up to infinity.

## Flatness Problem

When the universe came to be, it could assume a likely shape: a sphere like a drop of water, or a closed curved surface like a soap bubble, or an open curved surface like the shape of a saddle, or flat like a sheet. Based on observations the cosmologists say that the universe is flat without any

curvature in it. It is counter-intuitive to imagine that when the universe was only $10^{-35}$ sec old, confined in a point in the space having uniform mass/energy distribution in it, it would yield a universe without a warped up space. Massive celestial objects are supposed to massively warp the space around them! Not only that, the modern cosmology suggests that universe's history was decided in that short Quantum Physics time-regime. Nevertheless, the meaning of flatness of the universe is addressed in the following as the "Flatness Problem".

It was known for decades and has also been confirmed from the recent measurements of CMBR from COBE satellite and Hubble Telescope that the density of matter in the universe was very close to the density required to make the universe flat. What does this flatness mean? The flatness property of the universe for cosmologists/astronomers has a different meaning than commonly envisaged. One comes across a lot of confusion about the flatness of the universe. The flat universe does not mean that it is flat like a sheet with negligible thickness compared to its length and width. This flatness has nothing to do with the outside dimensions of the universe, rather it relates to the geometric properties exhibited inside the universe. The observable universe is spherical all around us and it does not look flat. In fact the entire universe could be spherical or ellipsoidal but it is still said to be flat. This property of flatness is observed inside the space of the universe.

To explain this, the astronomers take up the triangle-geometry. If a triangle is drawn on a flat plane like a table top, the sum of the three angles formed by the triangle add up to 180º. If a triangle is drawn on the surface of a sphere, a curved surface, the sum of three angles of the triangle is less than 180º. If a triangle is drawn on an open curved surface like a saddle, the sum of three angles of the triangle is greater than 180º. Another example to explain the flatness of the universe one draws two parallel lines on a surface. The parallel lines drawn on the flat surface will never meet even if extended to infinity. If parallel lines are drawn on a sphere such as the Earth, the lines running north-south, the parallel lines at the equator would begin to converge and meet at the pole. In case of a saddle shaped surface the two parallel lines will diverge.

Our universe is said to be flat because if a triangle is drawn in it in any plane formed by distant galaxies the angles of the triangle will add up to 180º. It is therefore also said that our universe obeys the Euclidean

Geometry and this simple geometry could be used to deal with the universe. There is no space warping in such a universe.

The flatness is also related to the density of the universe. The balance in the density of the universe is so critical that if it were a billionth more than what it is, the universe would have collapsed under its own gravity within a fraction of its age and if its density was a billionth less, it would keep expanding. No doubt that the criticality in the universe's density is mind-boggling and it is equally mind-boggling as to how the colossal universe with extreme mass took birth in an explosion! The Big Bang explosion to a modern cosmologists is a special kind wherein all nice things have happened and if they did not the Cosmic Inflation could make them happen!

The Big Bang cosmologists surmise that the Cosmic Inflation flattened the universe when it was subjected to 'False Vacuum' when it was also homogenized, made isotropic and led to further expansion. The flat versus the highly curved universe problem is also being explained at the Quantum Physics level. The Big Bang algorithm is tweaked to take care of the flattening of the universe during the Cosmic Inflation lasting for a duration of only trillion-trillion-trillionth of a second.

To learn that the Vedic Cosmology also creates, naturally, a flat universe, is mind-boggling! But this flatness relates to outside shape of the universe. The flattening of the Vedic universe is owing to the centrifugal force generated by the inherent rotation of the entire universe discussed in Chapters 9 and 10. It should suffice here that the rotation of the universe flattens it in the shape of a wheel.

## Magnetic Monopole Problem

Without elaborating upon this deficiency of the modern Big Bang Hypothesis the author summarizes that: among all kinds of fundamental particles created in the modern Big Bang mechanism, the particles called the 'magnetic monopoles' should also be created, but they are not observed anywhere in the universe.

# Red-shift Problem

The American astronomer Halton Christian Arp is well-known for his '1966 Atlas of Peculiar Galaxies' and other publications that raise doubt on the validity of the Big Bang Theory; one of his important publications is the book entitled 'Seeing Red: Redshifts, Cosmology and Academic Science'. In an article he said: *'There is now a fashionable set of beliefs regarding the workings of the universe, greatly publicized as the Big Bang, which I believe is wildly incorrect'*. Among other things, Arp's dissention from the Big Bang Theory is based on the relationship between the amount of redshift in the spectrum and the recession speed of the galaxies. The higher redshift represented greater speed of recession of the galaxies and that they were also farther away from an observer on the Earth. Arp in his observations found that some quasar-pairs (quasi-stellar objects) exhibited high redshift that would put them at great distances from the observer on the Earth, but they in fact belonged to a nearby galaxy that showed low redshift of its own. Also, older quasars which are supposed to be the farthest astronomical objects must be moving away with the greatest velocities. The farthest quasars however did not fit in the highest redshift category because the older quasars exhibited lowered redshift. This leads to the conclusion that the speed of a cosmological object was not necessarily responsible for its redshift and conversely, a redshift did not necessarily represent the distance of the object. Also, the present general understanding from Big Bang that the farthest galaxies were moving away with the greatest speeds was not true either.

Cosmological objects, including the Sun, exhibit intrinsic redshift of their own, even when not moving away from the Earth. The intrinsic redshift in all illumined cosmological objects relates to their state and age. The other source of redshift is thought to be the Compton Scattering where a high energy light photon upon hitting a free electron or hitting an electron loosely bound in an atom, is scattered with its wavelength shifted towards red, just what the Doppler Effect does in the case of a moving source. Those who suggest that the observed redshift from far away galaxies is the accumulation of Compton Scattering in the light passing through the inter-galactic matter and through the predominantly present Hydrogen, argue that

in the Big Bang Hypothesis the notion that the ‘red-shift equals distance’, is erroneous and needs a re-examination. If the universe is homogeneous and isotropic the red-shift must represent that too. But it seems there is observed asymmetry between the east and the west red-shifts. Most of the details related to the red-shift are an issue in the Big Bang. They are not included here for they relate to complex concepts specific to astronomy. The red-shift will however be discussed again in Chapter 9 in relation to the Vedic Cosmology with new mechanism for the creation of the universe. Part of the red-shift according to the Vedic scenario could just be an artifact of the dynamics of the rotating universe.

## Dark Matter/Dark Energy Problem

What we observe and see as a part of the splendour of Nature in the form of stars and galaxies is only 4% while the rest of the 96% that we do not see is supposed to be the hypothetical Dark Matter and Dark Energy discussed above individually. Dark Matter and Dark Energy are said to be permeating through the universe and forming a huge proportion of it, however, no laboratory experiments have been able to harness either of them. For balancing the field equations to get desired results the Big Bang Theory hinges on these two unknown entities of the universe. They are said to be parameters for 'fine tuning' by the adherents of the Big Bang but are thought to be the 'fudge factors' by the dissenters. The problem is that the true nature and composition of either is not known.

## Other Thoughts on Big Bang Hypothesis

In addition to the questions raised by other physicists on the Big Bang Hypothesis with the Cosmic Inflation being a sub-hypothesis within it and False Vacuum energy as a sub-sub-hypothesis to create Cosmic Inflation, this author has some संशय: (*sanshaya* = doubt) and the questions of his own.

## (1). Big Bang Hypothesis at Cross-roads

The momentary False Vacuum with the property of repulsive gravitational field is said to be the sole cause for the explosion and Cosmic Inflation in the Big Bang. The 'naïve Cosmic Inflation' of the 1980s, as Steinhardt labeled it, created a single universe. The 'smart Cosmic Inflation' is said to continue creating multiple universes at other points in space outside our universe. In this never ending Cosmic Inflation, always present somewhere in space outside our universe or possibly even within it, the overall Big Crunch (the collapse of universe unto itself) scenario does not seem likely. Even if our universe is to go for a Big Crunch, the physics logic dictates that it will never take place within the framework of the Big Bang Hypothesis, even if the gravitation dominates the Dark Energy. It is

the Cosmic Inflation that would not let it happen! The universe cannot come to an end. This is discussed below.

To understand this let us take an imaginary reverse ride on the universe moving towards the Big Crunch. To move towards a Big Crunch means the gravitational force will pull all galaxies closer together increasing the matter density of the universe. While increasing the matter density the universe will reach a point in time when its density is the same as it was at the end of Planck Era at $10^{-43}$ sec after the onset of Big Bang. Recall that this also was the time when the ghost of the False Vacuum manifested itself at the end of $10^{-43}$ sec. An unavoidable situation must arise at this point– the density of matter in this Big Crunch reaches back again to what it was when the universe was being created. Such a density value is reached before the matter even reaches that finishing line called space-time singularity.

At this point in the universe's life the unavoidable indeed is the apparition of the False Vacuum again. This False Vacuum must do again what it was hypothesized to do when the universe had entered from Planck Era to Inflation Era. The repulsive gravitation in matter under the False Vacuum sends the universe back on a new course of Cosmic Inflation leading to the creation of exactly the same universe that we live in now. Obviously the ghost of the False Vacuum would not let the universe go right back to the space-time singularity where it had started first. This is equivalent of saying that the ghost of 'repulsive gravitation' will never let the universe reach back to its original condition of space-time singularity. Therefore, this is also equivalent of saying that the matter density condition creating the False Vacuum, again becomes responsible for the Big Bang explosion.

Thus, if the False Vacuum is a reality, the true Big Crunch will never be reached. The consequence of this is that the universe will oscillate between the Inflation Era and its most expanded era. This is also a kind of birth-rebirth scenario for the universe. The big question to cosmologists is – if the Big Crunch is part of the modern Big Bang Hypothesis, it is meaningless to start the universe from the space-time singularity because that point is never reached, then why not begin the universe from the Cosmic Inflation and save $10^{-43}$ seconds from the universe's life? If the cyclic birth of the universe is discounted by the Big Bang cosmologists they have only one choice for the fate of the universe - the Big Chill. The universe in a Big Chill scenario can be created only once because in an

eternity of Big Chills there are no more space-time singularities left. The consequence of this is that our universe is the last.

Hawking and others who professed that the gravitation of the universe ultimately will bring all matter of the universe to a Big Crunch have to consider the ghost of the False Vacuum which will never let the universe pass-by towards the dimensionless Big Bang singularity. The hurdle of the False Vacuum, if real, poses one other logical difficulty that the Time entity pre-existed at $10^{-43}$ sec. Then who is competent enough to proclaim that the Big Bang began at t = 0 sec in a singularity which can never be reached again till eternity? If the False Vacuum is a real phenomenon, the Big Bang singularity is only an illusion in the mathematical construct of cosmologists and if the Big Bang singularity is a real phenomenon then the False Vacuum is an illusion. The only way out of this 'cosmic dilemma' is to advocate the Big Chill.

So, now the question is – is it the Big Crunch or the Big Chill? One of the following two things should happen:

(a) If it is a Big Chill the universe is a onetime phenomenon and the Space-entity cannot again form a particle let alone a universe?
or

(b) If it is a Big Crunch then the universe is in a permanent mode of rebirth cycle oscillating between its full-fledged life and the False Vacuum in Inflation Era without ever reaching back to its space-time singularity.

The author summarizes this situation in the following deduction:

**Deduction:**

"*If the False Vacuum is a reality the space-time singularity is only a mathematical imaginary condition. Conversely, if the matter of the universe reaches the Big Crunch acquiring its true definition of space-time singularity, the False Vacuum is an imagination. If there are no convincing answers to these questions then the Big Bang Hypothesis itself is modern cosmology's big imagination.*"

There is a likely-hood of some explanation about the False Vacuum dilemma discussed above; however, there is recent thinking in cosmology advocating for a perennial cycle of birth and death. This is no different from the qualitative Vedic scenario with the difference that the universe in the

Vedic cosmology takes as long a rest in the *pralaya* (dissolution phase) as long it is active in its *srishti* (creation phase). Several USA scientists at Princeton and Cambridge are working on a theory different from presently conceived in Big Bang, called the "Cyclic Universe Theory" (Steinhardt and Turok, May 5, 2006, Science) where the universe comes into existence with a bang not once but in endless cycles of death and reincarnation. Obviously the present cosmology is at the crossroads, not knowing which route to take and where the universe would end up, in a Big Chill or in a Big Crunch. To put it metaphorically, as it stands now, the universe at the hands of contemporary Big Bang Hypothesis is a confused entity!

The term False Vacuum itself is confusing because on one hand it is a vacuum but on the other hand it is not a real one. Etymology of the term 'false vacuum' conveys that 'it is a phenomenon giving the false impression of vacuum'. A vacuum by definition is devoid of matter and therefore it is supposed to be at low pressure or no pressure. The False Vacuum should then have high pressure. This is logically possible when there is matter in it yet exhibiting absence of matter to make it false. A Big Bang scenario is far from this where the early universe conveys the impression of matter at high pressure (opposite of vacuum) and does not convey the impression of a strong repulsion which is implicit in the term 'false vacuum'. Why introduce terms in science that increase confusion in the Big Bang Hypothesis?

## (2). Matter Speeds in Cosmic Inflation and Quark Lepton Eras – A Puzzle

Others may have raised questions about the questionable speeds of matter in the Cosmic Inflation and Quark Lepton eras that are in violation of the Theory of Relativity. The Big Bang cosmologists may have even put forward some convincing explanations for it. However, this author wishes to point out an interesting puzzle.

The matter of the universe from the onset of the Big Bang at t = 0 seconds onwards, rushes outward expanding the universe from a point in space-time singularity to ever increasing dimensions. As presented in Table 2.1a, a Big Bang era (epoch) is assigned the time of its beginning and the time of its end. The size of the universe corresponding to each era is also

listed. An average speed of the moving matter within an era can be calculated from the change in radius of the universe in that epoch divided by the time interval of that epoch.

The Table 2.1a is repeated here as Table 2.1b with an additional column presenting the calculated average speeds of matter in the five eras of the universe. The last column in the table represents the estimated speeds of matter at the beginning of an era and at its end. The multiplying factor c is the velocity of light c = 3x108 m/sec. The numerical factor with c when greater than 1.0 indicates that the average speed of matter in that era is greater than the velocity of light.

**Table 2.1b: Average speeds of expansion in the Big Bang.**

| Era (Epoch) | Duration from t= 0 sec | Radius of Univ. | Times the speed of light c =$3x10^8$ m/sec |
|---|---|---|---|
| Planck | 0 to $10^{-43}$ sec | $10^{-35}$ m | 0.0c to 0.333c |
| Cosmic Inflation | $10^{-36}$ to $10^{-32}$ sec | 1 m | 0.333c to $3.33x10^{21}$c |
| Quark-Lepton | $10^{-32}$ sec to 10 sec | $4x10^{13}$ km | $3.33x10^{21}$c to $1.33x10^{7}$c |
| Radiation | 100 sec to 3000 Yrs | $5x10^{14}$ km | $1.33x10^{7}$c to 0.0176c |
| Matter | 3000 Yrs to 13.8 | $3.4x10^{23}$ km | 0.0176c to --- |

Notice that the three middle epochs exhibit speeds of matter higher than the speed of light with the Cosmic Inflation and Quark Lepton Eras registering speeds of matter ridiculously higher than the speed of light. This is a puzzle created by the Cosmic Inflation hypothesis. It is not the puzzle that inflation should have the highest speed because the inflation by definition is arbitrarily designed to accelerate the process, but what is being accelerated is the matter of the universe which should follow common physics. A process to have speeds higher than the speed of light is in violation of the Theory of Relativity and is therefore quite puzzling. The highest of all speeds being $3.33 \times 10^{21}$ times the speed of light is in the Cosmic Inflation Era. With the value of the velocity of light c taken into account the highest speeds attained by matter in Cosmic Inflation is $1 \times 10^{30}$ m/sec, This in common expression is million-trillion-trillion meters per second, which for all practical purposes is an infinite speed. The question is – does the primordial matter of the early universe travel with such speeds in Cosmic Inflation Era?

Even in the beginning of the Radiation Era, when the universe is dominantly radiation, the speed of radiation (matter) being $1.33 \times 10^{7}$c is higher by a factor over 10 million than allowed in the physics of the present universe. Do photons of the Radiation Era travel faster and then slowdown in another era? There is no known physics process that would bring all photons back to their speed called 'the speed of light'. The photons travel with the speed of light because by nature they are mass-less. What will make them even lighter to fly at billion-trillion times their normal speed? Why talk about the photons, even the matter of the early universe is spreading out at these incredible speeds.

Notice from the first row in Table 2.1b that the matter in the first era (Planck Era) moves by acquiring maximum speeds that are only about one-third the speed of light, which is reasonable. The matter in this regime may be of undefined nature but it is matter and not the radiation (light). The matter is to move with speeds less than the speed of light, which is alright in the Planck Era, but as soon as the Cosmic Inflation begins, the matter is shown to expand violating Relativistic Mechanics. The simple logic is that for the Cosmic Inflation to have speeds higher than the speed of light, the matter in that regime must have lost mass and become something subtler

than a photon of light to travel at such higher speeds, as shown in the second row of Table 2.1b. There is no known mechanism in physics that would suggest that the conclusion of Einstein's Relativity could change under certain circumstances that would permit matter speeds higher than the speed of light. Any matter approaching the speed of light by the definition of General Relativity should exhibit infinite mass. It is during the Radiation and the Matter Eras (last two rows in Table 2.1b) when the speeds are shown to return to reasonable values. Therefore, from a normal physics perspective there is something inherently wrong with the Big Bang Hypothesis with Cosmic Inflation as its soul.

To explain a situation such as this the cosmologists could resort to more hypotheses. Would that make progress in finding the 'truth'? If the resolution of this speed discrepancy is based on more non-provable hypotheses, without provable physics principles, does it belong in the physics arena? It seems that the problem is not with the resolution of discrepancy but with the Big Bang Hypothesis itself. The Cosmic Inflation has no physics rationale to be considered in cosmology but it is there because it helps create a good-looking imitation of the universe. It is time to give a better start to the Big Bang Hypothesis, if that is the hypothesis to carry forward. The modern cosmology needs a fresh start.

From the articles on cosmology this author noted some explanations on these physics-defying and commonsense-defying speeds of matter, especially in Cosmic Inflation and Quark-Lepton Eras. One explanation is that it is not the matter of the universe that is travelling beyond the speed of light, it is the space-time continuum itself that is expanding at tremendous speeds and the matter is only taking a ride on it. Implicit in this premise is that no physics laws are violated because the matter itself is not moving with these ridiculous speeds. This raises several other questions. If the newly formed matter in the space-time singularity during the Planck Era follows the rules of Quantum Physics and exhibits only a third of the speed of light and later in the rest of the life of the universe the matter follows physics but if the Cosmic Inflation creates speeds of the order of $1x10^{30}$ m/sec, the Cosmic Inflation must lie outside the realm of physics? The speed of matter right up to the radiation Era is non-physics.

If one says that it is the space-time singularity that behaves that way and not the matter in it, then it is not sufficient to assert that the Space and Time are real entities but a cosmologist has to explain what is at the fine

structure of these quantities that makes them behave differently and only once? What physics principle causes the space-time to expand the matter at these speeds? To put it differently - what is the known physics mechanism that stretches the space as well as time to expand the so-called space- time continuum at extreme speeds?

Energy is responsible for expanding a substance. For energy to expand a substance, the energy has to permeate the structure of the substance. Those who suggest that it is not the matter but the space-time that is expanding at such high speeds, have to accept that the expanding energy permeates through the structure of the space-time continuum. So, now the new question is - does the 'space' or 'time' or the space-time continuum have a structure? More hypotheses could be brought in to guesstimate the answers to this question; however, the fact is that physics does not seem to have an answer to this question. Therefore it does not sound logical to say that during Cosmic Inflation when the universe expands only the space-time expands and the matter only takes a ride on it.

Another problem with the argument that the space-time expands with unrealistic speeds and the matter only takes a ride on it relates to the interaction of the matter and the expanding energy, whatever that might be. At its most fundamental level even the matter is not a continuum but it is a corpuscularized entity because it is created particle by particle. Therefore, the primordial matter of the universe after the Planck Era has a structure for the expanding energy to permeate. There is no strong logic to suggest that the energy permeates the space-time structure and not the matter structure. Therefore if the space-time is expanding at ridiculous speeds the primordial matter embedded in space-time must also move at the same speeds. So, now the new question is- is the matter expanding the space-time that holds the matter or is the space-time expanding and giving a ride to the matter?

Another suggestion to resolve this speed dilemma is that because the expansion is so fast that the matter has no time to move and therefore there is no speed in matter and therefore there is no speed violation. If the 'space-time' has time to expand, the space also has time to expand. Then why does matter not have time to move? The example of two high-speed jet planes flying in opposite direction, separating from each other with twice the speed is generally presented. This example is not valid here because the speeds involved (Table 2.1b) are extremely high.

## (3). Contemporary Big Bang in Ancient Logic

When the inherent logic in the Big Bang Hypothesis and its hypotheses within hypotheses is examined from its beginning in a dimensionless space where space and time are first born, not knowing out of what and with what mechanism and when the False Vacuum in the Cosmic Inflation is said to cause a big explosion, pushing matter at speeds transcending both, the imagination and physics, this author puts the label of हेत्वाभास: (*hetvaabhaasah*) on the Big Bang Hypothesis. Rishi Gautam's Nyaaya Sutra (Nyaaya Philosophy: the logic system) considered as the oldest of the six Vedic Darshans written in the far antiquity of the Vedic Civilization, anterior to the Mahabharata period near 3140 BCE, defines the term *hetvabhasah* as '*something that sounds logical but it is not*'.

Rishi Gautam's full *sutra* is -

सिद्धान्तमभ्युपेत्य तद्विरोधी विरुद्ध: (1/2/6)

(*Siddhaantam-abbhyupetya tadvirodhi viruddhah*) which translates into:

"*Accepting one principle on the basis of another principle which is based on pseudo logic*". (Nyaya Darshan, 1/2/6)

## (4). More Problems with the Contemporary Big Bang Hypothesis

Not detailed here, however, there are a number of other Big Bang deficiencies pointed out by physicists, astronomers, astrophysicists and cosmologists. These are accessible to a reader from the open science literature. To name just a few of these deficiencies: density discrepancy between the present and the infant universe; inconsistency in age and evolution of galaxies; too many assumptions in the Big Bang to create the right proportions of elements; some cosmological formations seem older than the Big Bang universe; no proof as yet of equal amount of matter and anti-matter being formed in the early universe when the present universe is dominated by matter only. There are more such concerns.

# Other Modern Cosmology Theories

There are a number of cosmological theories under the general heading, 'Classical Cosmological Theories'. Only a brief discussion on them is within the scope of this book. Some of these theories fall under "Steady State Cosmology" where the universe is considered to be infinite and is in a perennial process of new matter creation. In a steady state scenario there is no beginning or end of the universe. These theories came forward as an alternative to the Big Bang Hypothesis. Galaxies in Steady State Cosmology are considered not to be moving away from each other and therefore the universe is not expanding. The basic premise in steady state cosmology is that the matter is continuously being created and being destroyed (disappears), sustaining the eternity of the universe.

Jayant Narlikar, an astrophysicist, the author of Hoyle-Narlikar gravity theory fame, supports the steady state cosmology and also implicitly suggests that the General Theory of relativity 'started on a wrong foot'. It implies that the Big Bang Hypothesis approached the problem of the origin of the universe in an unnecessarily complex manner using the space-time continuum which ends up into singularity where the physics breaks down with vanished geometric definition of space at infinite temperatures. Narlikar rewrote Einstein's field equations and in his theory (Annals of Physics, 107, 325, 1977), Newton's gravitation constant G is no more a constant, rather it decreases with time, the mass of a particle varies with time and is a function of the rest of the mass of the universe, the space is flat and time is uniform. It seems that Narlikar's theory explains intrinsic red-shift and the red-shift in general. It is also supported by observations and thus remains congruous with deductions of relativity.

The doubts and questions about this theory relate to the steady state of the universe itself and that the mass of a newly created particle is proportional to the rest of the mass of the universe. If the universe is infinite, its mass must also be infinite, then how does a newly formed particle somewhere in the universe sense as to how big it has to be born to maintain proportionality and to keep a balance? What is the mechanism of this instantaneous communication between all parts of the universe to keep the mass of the universe steady?

It could be said that under the Steady State Cosmology the universe is infinite in space and time and it continuously creates the feed that is being

consumed by the perpetual machine of the universe. There are other contemporary theories of the universe that put a limit on the age of the universe, some accept an age much smaller than Big Bang's 13.8 BY and others go up to a trillion years.

Another cosmological theory is the "Cyclic Universe Theory'. It was put forward in 2002 by Paul Steinhardt of Princeton University and Neil Turok of Cambridge University (May 2006, Science) wherein the universe recycles with new matter and energy created about every trillion years when two sheet-like branes of Strings Theory collide along an extra dimension of space. In the proposed cyclic universe, the Dark Energy responsible for the universe's expansion and represented by the Greek letter lambda $\Lambda$, discussed earlier, is theorized to diminish with time and with every cycle of the universe's birth. This process is said to have led to the creation of a unique universe each time. The present value of $\Lambda$ is said to have created our universe which is unique the way it is. The mechanism of this theory is different but the eternal cycle of the universe's reincarnation is similar to the thought in the Vedic Cosmology.

## Author's Queries and Deductions from Modern Cosmology

An essential precondition for the Big Bang Theory is the pre-existence of all matter (Lemaitre's super-atom) at infinite temperature, at one point called the space-time singularity. On the other hand the particle physicists insist that the universe came out of the space-time singularity out of nothing. If not pre-existent, all matter of the universe in the Big Bang Hypothesis is said to have manifested at one dimensionless point in space-time singularity. A common understanding from the behaviour of the present universe is that the temperature is always exhibited by the presence of matter. Therefore, matter being the shelter of temperature, it is imperative that matter pre-existed in the singularity, or co-existed simultaneously. Without this requirement one cannot say that the singularity was at an infinitely high temperature before the Big Bang. If the Space was non-existent in space-time singularity but it was created then at what point was its start?

If one assumes that the Space is nothing but an effect of the presence of matter, then it is not a physical entity by itself because an effect cannot

assume the status of an entity. Also, those saying that the Space and the Time are a part of the same continuum without their independent existence, must then agree to the logic that it would not be meaningful to call them two separate entities. Pertaining to the Space and the Time entities, several arguments based on the Vedic frame of reference were presented in Chapter 1. More unique insight into these entities is presented in Chapter 5.

One cannot form a space-time continuum without the Space and Time being two independent and different entities. On the other hand if two entities are merely the "effects" of two different 'causes', one cannot create a continuum with two different 'effects'. This author emphasizes the philosophical principle that two different 'effects' cannot form a continuum because one does not see that happening in the universe. This basic principle negates the idea of forming a space-time continuum. When the fine structure of the space-time continuum (if it exists at all) is considered, the logic in forming the space-time continuum itself does not stand.

The Time must precede the Space because otherwise in what would one create a Space for the Space to do the next thing, like its expansion, which is a time-dependent phenomenon? Since we are talking about creating infinitely small steps of the entities and if the Time is created first, the very first step of Space would lag behind the time-step. If the Space and Time are created in succession one will miss the other at least for a small time span before taking part in a continuum. The only way they form a space-time continuum is to string them in succession with time first and with a change in the nomenclature – 'time-space' continuum rather than 'space-time' continuum. Also before the step of Space is created, the step of Time is alone. Then who is to guarantee that the step of Space would not miss out the step of Time and render the space-time continuum to be only an imaginary process! If the two entities are quantized, the time quantum must precede because otherwise what time-stamp will the first quantum of Space have? Can anything be created without it being in Time? It does not seem likely. If somehow their first quanta are created simultaneously, to begin forming the space-time continuum, cosmologists must explain what physical process would create two entities of differing nature simultaneously. The cosmologists do not know this yet. It is not obvious from the Big Bang Theory as to when, before or after $t = 0$ sec the Space was made available and to what extent, for the big explosion to take place in. Therefore, the Big Bang should have either a mechanism to create both,

the Space and Time, or there are two independent mechanisms for each with simultaneous onset to create them simultaneously. For the time being the modern cosmology has not reached a point where clear answers to these questions are available. Meanwhile a certain degree of confusion about Space and Time certainly persists in the Big Bang Hypothesis.

The Vedic Cosmology does not have to worry about when Time and Space were created because these entities in Vedic Cosmology are eternal entities.

Most of universe's history of 13.8 BY has been spent to form celestial bodies and galaxies and just keep expanding. The universe after spending about 9 BY created our solar system with the Earth. Anthropology suggests that the thinking humans with analytical ability emerged on Earth only a few million years ago. It is difficult to explain why humans have not thought so deeply and scientifically about the cosmos 1 million years ago or 5,000 years ago? Why did they study the cosmos only in the past few centuries? Why is it that a theory like the Big Bang with the concepts of Time, Space and Matter worked out only recently? Why did the intellectual potential required for discovering the Big Bang did not exist in humans, centuries earlier? This apparently defies the principle that governs the rate of the evolution of a biological system that ultimately led to the thinking human-beings. We will not take this up here and instead just state that there have been times before, far in the antiquity of Vedic culture, when the sages, thinkers and the *rishis* have thought deeply about the origin of cosmos and have left behind intriguing theories and principles some of which are worth looking into. They not only addressed the anthropic enquiry regarding our unique universe and the subject of cosmology, but they have also shed considerable light to shatter the myth that any serious progress in science-thought has taken place only during the past few centuries.

The chapters that follow are an attempt to bring out the science-thoughts that are ancient yet reflect universality. If the vocabulary pertaining to a specific subject exists in a society the subject itself must have been studied by that society. The existence of rich terminology in cosmology in the ancient Vedas indicates that the subject of cosmology was explored in the far antiquity of the Vedic Civilization.

## Some Vedic Terms of mechanics used in Vedic

# Cosmology/Astronomy

To talk about the creation of the universe without giving some details of the process and giving credit for the creation to the Creator, is perhaps sufficient for a spiritualist but not for an analytical spiritualist, a philosopher or for a scientist whose emphasis might be to know more about the process than the processor. The theistic religions generally have credited the Creator for creating the universe and have said that the details and the knowledge of the process of creation are 'with the Creator'. Therefore, there was no necessity for developing cosmological terminology. Consequently, the terminology in cosmology in religious texts is found at a limited level. However, one would find that the Vedic terminology pertaining to cosmology, astronomy and physics in general encompasses the concept of creation of the universe down to the detailed nomenclature for the objects of the solar system and the related physical principles and phenomena. This should certainly tickle the minds of the intellectuals with theistic and atheistic orientation alike. The rich Vedic terminology not only relates to the Sun and the solar system, it also leads one to obvious and intriguing details about the Moon and the Earth, presented in Chapter 8. It does not stop at just saying that the Sun illuminated the Moon and that the Earth was round and in orbit around the Sun, the Vedic Cosmology in fact talks about the geology and geological substances and phenomena pertaining to the Earth. And all this was put together in the far antiquity of the human civilization. The *rishis* of the Vedas had a mind-grabbing story about the creation of the universe and they expressed their thoughts in rich Sanskrit terminology that is bound to attract the attention of intellectuals sooner or later.

If asked to narrate the story of the creation of the universe, a cosmologist of modern times will gladly start off with the Big Bang singularity and soon he would introduce a cornucopia of technical terminology necessary for him to proceed towards the end of the story. Modern cosmology is so involved that even with a rich terminology at hand a cosmologist (with some exceptions) could easily be labeled as 'bad story teller' because hidden behind each term is a complex concept that if explained, will put a listener to sleep. Term-rich modern cosmology, even if the terms were borrowed from Latin or Greek, is however well-equipped with terms to explain complex phenomena. If not from the Latin or Greek a

modern cosmologist would create new terms when the need arises. The meaning conveyed by the term Big Bang is 'big sound' that no one heard! Yet that seemingly meaningless term becomes meaningful with the history of the universe hidden in it.

A natural question arises – is the Vedic cosmology term-rich enough to tell the story of the origin of the universe? The short answer to the question is yes. The validation to the answer requires listing and defining a large number of Sanskrit terms pertaining to the subject of cosmology, which is deferred to the chapters that follow. To give a flavour of the Vedic terms of mechanics that relate to cosmology, the author is presenting here just a few terms that reflect the richness of the Sanskrit language and the intellectual depth of the wisdom of the Vedic *rishis* who used those terms in their mantra expressions.

A Sanskrit term is a lens for its own meaning to create its instant real image. For example a frequently occurring term is *chakraprasaran*. It represents two actions: '*rotating around an axis and spreading radially, keeping its circular shape*'. Although the term has occurred in the context of Vedic cosmology to be discussed later, a simple example of *chakraprasaran* is the ripple effect created on the surface of still water when a pebble is thrown in it, where the spreading of the matter (water in this example) is in a circular fashion. The term has been used in the Veda mantras in the context of the matter of the universe spreading in space while spinning around an axis.

The other term close to it with the same prefix of *chakra* (circular) is *chakrampari* (RigVeda, 7/63/2) which stands for '*circular motion around an axis keeping the rotating object within a circumference*'. Its application, as described in this mantra, is for the Sun's control on the orbits of the objects of the solar system. Factually in that RigVeda mantra the usage of *chakram-pari* is in conjunction with three other most used terms of mechanics, समानं (*samaanam*) means **invariant** or **stable;** अविवृत्सन् *(avi-vritsan)* means **repetitive circular motion** and धूर्षु (*dhoorshu*) means the **axis** (of rotation). The subject matter of the mantra being the *Surya* (the Sun), the usage of these terms creates a picture so vivid that one can have no other meaning of it but - *"The Sun keeps all planets rotating around their stable axes in their stable orbits"*. This is not the only mantra teaching science and delineating what it teaches, a large number of them express

similar thought explicitly. More of such mantras that form the basis for the Vedic Cosmology Principle are presented in this book.

One interesting observation for a linguist is the sound of the word *chakram-pari*. The pronunciation of the word *chakram* is not very far from the pronunciation of the term 'circum' in modern mechanics; also having the same meaning. The whole Vedic term *chakram-pari* is not too far in sound from 'circum-peri' leading to 'circum-perimeter' or 'circumference'. Not just that but *chakram-pari* also has the same meaning as the term circumference. Other examples of terms in mechanics are: *pari-kraman* which defines the '*step-wise motion on a circle*', while *paryaplavan* (Shatpath Brahmana, 11/1/6/2) is '*a large scale circular rotation around an axis of a system in floatation*', like the rotation of the solar system or a galaxy in space. The term *syandan* (Shatpath Brahmana, 3.9.2.1) is '*flow in togetherness*' (in reference to the flow of *aapah* the primordial matter of the universe), *urmim* is *vibrations or waves*, विततः (*vitatah* in RigVeda 10/129/5) is '*instantaneous expansion*'.

All thoughts and terms in the Veda mantras are to enhance the knowledge in all realms of the creation, the physical and the spiritual. When one comes across these specific terms of physics and mechanics in particular, one cannot help but emphasize that they are primarily to enhance the knowledge of the physical aspect of the creation. The sheer presence of such specific terms in the mantras, with specific physics meaning contained in them, tells us that there is physics in the Vedas. The terms in this small sample and more to come in the forthcoming chapters, relate to the early stages of the universe, the objects of cosmology and the solar system. These specific terms lead to the conclusion that the Vedas in the antiquity of civilization talked about cosmology, astronomy and the heavens. This is worth looking into from the science perspective. In the chapters that follow, the mantras and individual Vedic Sanskrit terms are analyzed and interpreted to build the story of the universe from the Vedic perspective. The next chapter is devoted to proving the historicity of Vedic references used in this book. All Vedic references were formulated in the distant antiquity of the Vedic Civilization, anterior of 5,000 years.

# HAPTER 3: The Historicity of Vedic References The References on Cosmology Precede 5,000 years

# The Vedic Reference Hypothesis

The reference material used for this book is in three basic categories: 'dated', 'partially-dated' and 'undated'. The dated material includes published books, records and articles that are available from publishers, libraries, journals and web-sites with authorship and dates in known history. An example of this category comprises the recent peer-reviewed published journal papers by a large team of Indian national scientists on the geological discovery of the ancient, now extinct mighty River Sarasvati that flowed from the Himalayan foot-hills to the Paschim Sagar (Arabian Sea) in the North-West India.

Another example would be the historical records at the four different Aadi Shankaracharya Mathas (monasteries), written serially with calendar dates starting near 500 BCE till now. An important feature of these records is the congruity among them even though they were maintained independently in different locales of the Indian subcontinent, that were arduous to travel from one to the other. These records commenced from the laying of the foundation-stone by Aadi Shankaracharya himself at Dwarka Matha in Gujarat state on kaartik badi trayodashi in the year 2648 of Yudhishthir Era (YE). This exact date in the luni-solar calendar is the 13th of the dark lunar phase of the YE Calendar that was in use at the time. This could be converted to the day, month and year in Common Era (CE) or Christian calendar with accurate computer algorithms now available. However, a quick round off within the accuracy of a month yields that the above date falls in October 492 BCE.

The term 'recent' in historical accounts is generally used for events well-known and it relates to the age of a society. For a Western society the references of World War II may be considered recent whereas in a millennia-old Vedic society, the written records at Shankar Matha may be termed as recent. However, because the records at the Mathas are in calendar dates based on luni-solar calendars well-implemented and practiced in the society, with frequent entries of other important celebrations at these Mathas, they could be termed as the 'dated' material as well. These records have enabled this author to establish the historical accuracy of the Vedic references used in this book.

The 'partially-dated' references are those that are relatively ancient, that are referenced in authentic texts and are available as published books, manuscripts or records. Although some references may have the day, the month and the year of a calendar, the others may only record calendar year or the century. The ancient history books such as Rajtarangini written in Sanskrit by Kalhan in 1148 CE on the genealogy of the Kashmir kings going back to 5000 years from now, falls in that category. For the historians who are interested in data accurate to within a year, a book such as the Rajtarangini could be better than a 'partially-dated' reference. The age of the book cited in the published material in terms of centuries or millennia could be considered in the category of 'partially-dated'. Some of the references in this category may only have the name of the author and the year or a specific century assigned to his/her written text. Examples in this category are books and manuscripts referred to in the book of Satyarth Prakash written and published in 1881 CE by the great Sanskrit scholar of the Vedas, Swami Dayanand Sarasvati, mentioned a number of times in the previous chapters.

The third category of 'undated' references will generally include ancient writings for which it is difficult to assign a date or a period. These are the significant books that helped guide the values of the society, its education system, its governance, science, philosophy and religion. The identity of these books has remained as real as the existence of the people who have been reading them, learnt them by heart, hand wrote them in the form of manuscripts and books, and now are available in printed and published form. The ancient Vedic Literature beginning with the four Vedas and their Brahmanas (commentary books) rights up to the six Vedic Darshans are included in this category. Of the six Vedic Darshans (philosophy books) the last two in fact fall in the category of 'partially-dated' reference material, because they relate to the Yudhishthir-calendar of the Aryans and are contemporaneous to two well-known milestones in the Aryan history: the onset of the Vedic natural calendar (*Srishti Samvat*) on February 18, 3102 BCE and the end of the Mahabharata War and the coronation of the emperor Yudhishthin in 3140 BCE.

References and the data presented in this chapter provide proof that the Vedic cosmological ideas presented in this book are indigenous to the Vedas, Smritis and Sutras and are based on independent thought of the Vedic *rishis* with no relation to the traditions and civilizations external to India such as the Judaic/Christian/Moslem traditions or the Egyptian, Babylonian and other ancient civilizations. Also these Vedic ideas, older than 5,000 years (3000 BCE), may have some remarkable similarities with the modern cosmological theories and principles, yet they are original and uninfluenced by modern cosmology, the latter taking off in the Western society during the past four to five centuries only. Even though the Vedic ideas are from the far antiquity of the Indian Civilization this author has arbitrarily placed a boundary near 5,000 years in the past, before which, or even closer to it, no other non-Vedic Civilizations generated ideas similar to those in the Vedas.

Though graspable only by the chosen few, the modern cosmological ideas and theories have developed systematically over the past century. When it comes to indigenous applied Indian Astronomy, it is based on observational and complex mathematical disciplines. This is contained in several well-known treatises in Sanskrit. When it comes to physics or cosmological principles laid down in Veda mantra formulations, they generally are not presented with pre-set mathematical equations to go with them. Nevertheless, the basic science thoughts in the mantras are similar in many aspects to those in modern physics and cosmology. The aim of this chapter is to establish that the two disciplines, modern cosmology and the Vedic Cosmology are separated by a big span of time and that the Vedic science-thought was not affected either by the Greek or by the early Judaic/Christian philosophy. The unidirectional flow of the Time entity dictates that the originality of the Vedic thought in the exalted minds of the *rishis* of antiquity was certainly not a beneficiary of the modern thought in physics and cosmology.

Not all ideas put forward in contemporary physics and cosmology were the final word of truth. Many deductions of physicists have weathered the times while many others have disappeared. Over a century alone a change in methodology has also brought about drastic change in cosmological ideas and scientific deductions. In contrast, a Veda

mantra is an invariant entity. This invariance must have been arrived at after considerable mental exercise by a *rishi* or many *rishis*. Considering that the Veda mantras cite absolute numerical figures in billion years for the age of creation, the numerical time-division going down to milliseconds, the accuracy in the speed of light and so on, hints that such deductions by the Vedic *rishis* must have resulted from solid mathematical, observational and measurement methodologies. If not on the blackboard, or in the laboratory or with large aperture telescopes employed by contemporary scientists, the Vedic *rishis* must have had some real means to accumulate knowledge and give it finality in mantra formulations. Since there is no direct evidence of complex mathematical treatments in the available Vedic literature on cosmology it is also thought that it is lost in the antiquity.

Based on the 'dated', 'partially-dated' and 'undated' references used in this chapter and on the historical information gleaned from authentic writings, this author formulates the following **Vedic Reference Hypothesis**:

***"The Vedic references on cosmology are ancient and precede 5,000 years"***

This hypothesis is proven in the following pages. The aim is not to establish the absolute age of the Vedas and the other reference books in the Vedic Literature, rather it is to prove that the references from the Vedic Literature cited in this book are older than 5,000 years. To be specific, the Vedic references in this book are older than a milestone at February 18, 3102 BCE. This date in the ancient Vedic history, as mentioned before, has a direct relation to the social calendars of the Vedic Civilization and their relationship to the Vedic astronomy. The proof of the Reference Hypothesis is acquired by establishing the historicity of certain historical events in the ancient Indian history, as the Indians have recorded in their Sanskrit Literature and Sanskrit history writings, including the most recent state-of-the art genome study of the Indian populace. A comparison of this with the historicity theorized by Western Indologists over the past two centuries will also be taken up.

## Proof of the Vedic Reference Hypothesis

The science of cosmology is the study of the history of the universe. The starting point of this history is also the starting point of the universe. If the starting point itself is misunderstood, there is a possibility that the universe is misunderstood or only partially understood. Nothing is final in the history of the universe yet. This is the situation even when exact science is used as an implement to excavate the history of the universe. More difficult from the exact sciences is the excavation of facts from the human history. Therefore, one has to depend on the best correlations and logical deductions to prove the Vedic Reference Hypothesis.

To understand the facts of the ancient history of a country or of a civilization one does not have the luxury of a cosmologist. To predict a universe, a cosmologist changes the parameters of the model, introduces new fudge-factors and carries out back-and-forth iterations to arrive at a final result. For one to understand the history of a country one has

to depend on what existed there in the form of the written historical records, the literature, the monuments, archeological finds and other signs of development of its civilization. Compared to billions of years of history of the universe the history of the human civilization is negligibly small, yet the human history is riddled with contradictions and confusion. The best one can do is to logically analyze the information and draw a conclusion. The Vedic references utilized in this book have the same situation. The attempt by this author is not to resolve the historical miscalculations of some Indologists alluded to in the previous chapters but to establish the positions of just a few important historical events in the Indian culture and civilization on a timeline segment of 5,200 years.

The citations of the Veda mantras in Darshan *sutras*, Smritis, Upanishads and the other Sanskrit Literature indicate that the references of the Vedas and the ancient Vedic Literature are anterior to the 5,200 year period. The reference to ancient texts is not just fleeting mention rather there is a strong historical correlation with the written Vedic Literature. A coordinate point in a history frame of reference needs three interdependent factors – a real geographical locale, real people and an actual time period. The specificity of these three factors together forms a specific milestone in the history of the place and the people. The importance of a milestone is reflected in the substantial contribution that a historical personality or the people at that time made to the society, be it in governance, or in the creation of literature or discoveries and inventions. A limited number of such milestones from the Vedic Civilization are identified and placed on a timeline with reference to the calendar in use.

## Timelines A and B

The Indian history from two perspectives is represented by two timelines in Figure 3.1. The Timeline-A is based on the well-researched, reliably recorded historical information in the Vedic Literature. The Timeline-B is based on the studies of the Western Indologists during the past few centuries.

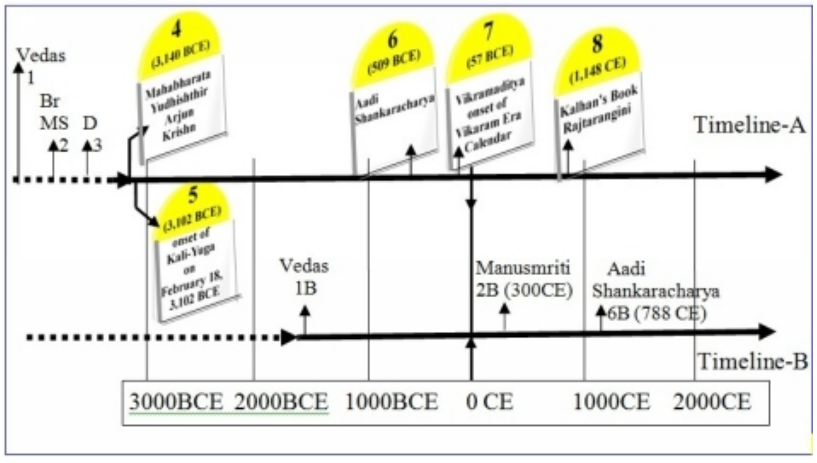



Figure 3.1: Timeline-A for the historical events according to the Vedic Literature and the Timeline-B according to the Western Indologists. (Milestone # 4 at 3,140 BCE,

#5 at 3,102 BCE, #6 at 509 BCE, #7 at 57 BCE and #8 at 1,148 CE)

Relevant to the text of this book the eight vertical arrows on the Timeline-A represent the eight major historical periods in the Indian history. The date in Common Era (CE) for the historical event is also enclosed in brackets at the marker, where available. Only three vertical arrows representing the three markers 1B, 2B and 6B are placed on the Timeline-B. The dotted line on the left end of the two timelines represents the distant past for which no specific historical events with dates are available from the Vedic Literature on Timeline-A or from the Indologists on the Timeline-B. Notice from the Timeline-A that the Marker-1 (vertical arrow) for the Vedas is placed left most on the dotted line. The Marker-2 on the dotted line of Timeline-A represents the Brahmana books (Br), Manusmriti (MS), Upanishads and numerous other literary works of Vedic Literature listed in Table 4.1 in Chapter 4. The letter D at Marker-3 of Timeline-A, also on the dotted line, represents four of the six Darshans (see Table 4.2).

Implicit in the Figure 3.1, as mentioned before, is that the Vedas are considered to have emerged in an unknown distant past of the Aryan Civilization long before the rest of the Vedic Literature. Marker-4 at 3140 BCE represents the events of the Mahabharata War, the epic book of Mahabharata and several contemporaneous great historical personalities; only three are mentioned on the Time-milestone-4.

The Mahabharata War, the book of Mahabharata, Yudhishthir and Yudhishthir-calendar were mentioned in Chapter 1. Emperor Yudhishthir at Time-milestone-4 is part of the long genealogy of the Lunar Dynasty at Hastinapur prior to Yudhishthir's coronation in 3140 BCE. Some more insight into the history at and around the Time-milestone-4 helps us strengthen the historicity of the Vedic references. Recorded genealogy is a vital part of the written history of a nation which cannot be ignored by those interested in the history of that nation. It is a window into the past and it certainly enables considerable insight into the Civilization. Several tables in the following present the recorded history available from the Sanskrit Literature, ranging from the ancient to the relatively recent times. An abridged genealogy of the Lunar Dynasty up to Emperor Yudhishthir is presented in the flowchart of Figure 3.2. Sometime after Yudhishthir's rule, the capital of Hastinapur was abandoned and the city of Indraprasth (modern Delhi) continued as the capital of the genealogy that followed Yudhishthir. A complete sequence of all Aryan kings from Yudhishthir down to the last Aryan king at Indraprasth (Delhi) up till the beginning of the Moslem rule is in Table 3.3. First let us look at the abridged genealogy of Yudhishthir's ancestors in Figure 3.2.

## Genealogy of Aryan Kings in the Lunar Dynasty: Pre-Yudhishthir Era

A solid arrow in the chart of Figure 3.2 represents continuity in succession while a dashed arrow represents discontinuity that may measure up to many generations and centuries. The flow chart of Figure 3.2 begins with the block labeled Aryavart where the term '*aryavart*' means '*the place of the Aryans*'. As was mentioned before, Aryavart is

India's original name before it came to be known as Bharatvarsh after the great King Bharat (fourth block from the top in Figure 3.2). Moslem invaders called it Hindustan (the place of Hindus), and the British called it India. After independence from the British in 1947 India's official name is back to Bharatvarsh. The second and the third blocks are not connected in a sequence because sometime in the antiquity of the Indian Civilization the two well-known lines of genealogy branched off to rule from different regions of India.

The solar line started from the great King Manu of Manusmriti. A famous historical milestone in that dynasty was the rule of King Ram. The Solar Dynasty ruled from the ancient city of Ayodhya established by Manu himself. The Lunar-line started from the King Dushant who married Shakuntala the adopted daughter of Kanva Rishi, a prominent name in Vedic Literature. Included here is some anecdotal information about the kings in the rest of the boxes of the chart.

There were numerous kings in the Lunar-line between Dushant and Bharat. Centuries passed after King Bharat when a king in the Lunar-line ruled who was industrious and action oriented. Owing to his dedication and noble karma for the nation he was addressed with his virtuous name Kuru. The Lunar-line after King Kuru assumed another name, the 'Kuru-vansh', meaning the 'Kuru-genealogy'. Centuries later in the Kuru-dynasty was born a king named Shantanu. In the flow-chart of Figure 3.2 the last nine blocks are devoted to the successive five generations between King Shantanu and King Yudhishthir.

The name of King Shantanu's queen was Ganga who gave birth to a son named Vedvrat. Later in life, King Shantanu fell in love with a forest-dweller's daughter named Satyavati and approached the forest-dweller (fisherman) for his daughter's hand in marriage. But the fisherman put a severe condition on King Shantanu that he would permit his daughter to become Shantanu's queen only if her first born became the next ruler of Hastinapur. On the grounds of morality the king could not agree to this condition because the rightful ruler to the Hastinapur throne was the prince Vedvrat, already a young man. Unable to marry Satyavati but still deeply in love with her, the King Shantanu went into depression. When the son Vedvrat came to know about this he could not bear his father's suffering. He took a vow not to ever get married, not to claim the throne and instead to lead a celibate life. Because this was a sacrifice and determination of a very high order Vedvrat from there on was reverentially addressed as Bhishm - the honour bestowed on him for taking up an insurmountable challenge. By the time of the Mahabharata War, the old prince Bhishm came to be known as Bhishm-pitamaha, the Grandfather-Bhishm.

Shantanu married Satyavati who gave birth to two sons, Chitrangad and Vichitra Veerya. Chitrangad died in war and Vichitra Veerya became the king. Vichitra Veerya had two queens Ambika and Ambalika. He was a lustful person with loose morals. While still young he died of *kshaya-rog* (the term in Ayurvedic medicine for tuberculosis), leaving behind two sons Dhritrashtra and Pandu under the guidance of their uncle Bhishm.

Dhritrashtra being blind from birth, Bhishm seated Pandu on the throne of Hastinapur. Pandu married Kunti (birth name Pritha) the daughter of the King Kuntibhoj.

Pandu had five sons: Yudhishthir, Arjun, Bhim, Nakul and Sahadev. By mistake Pandu killed a brahman pundit. Killing of living-beings is considered sinful but killing a brahman is considered to be a very serious sin; Pandu renounced the throne in repentance, took monkhood and went to the forest for meditation and self-realization. Pandu's first-born, Yudhishthir, was the heir-apparent of the Hastinapur throne but was too young to rule. Bhishm had no choice but to put the blind nephew Dhritrashtra on the throne of Hastinapur. This transition in the rule without change in generation is shown in the Figure 3.2 by the left-pointing arrow between the 11th and the 12th blocks shared by King Pandu and King Dhritrashtra respectively.

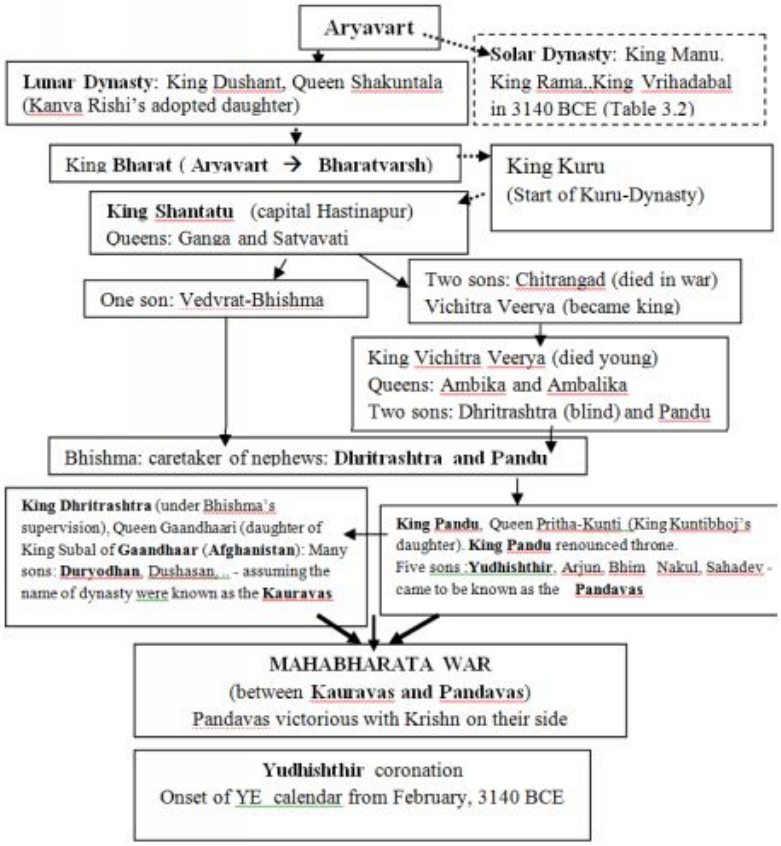

Aryavart
Solar Dynasty: King Manu. King Rama..King Vrihadabal in 3140 BCE (Table 3.2)
Lunar Dynasty: King Dushant, Queen Shakuntala (Kanva Rishi's adopted daughter)
King Bharat ( Aryavart → Bharatvarsh)
King Kuru (Start of Kuru-Dynasty)
King Shantatu (capital Hastinapur) Queens: Ganga and Satvavati
One son: Vedvrat-Bhishma
Two sons: Chitrangad (died in war) Vichitra Veerva (became king)
King Vichitra Veerya (died young) Queens: Ambika and Ambalika Two sons: Dhritrashtra (blind) and Pandu
Bhishma: caretaker of nephews: Dhritrashtra and Pandu
King Dhritrashtra (under Bhishma's supervision), Queen Gaandhaari (daughter of King Subal of Gaandhaar (Afghanistan): Many sons: Duryodhan, Dushasan, .. - assuming the name of dynasty were known as the Kauravas
King Pandu, Queen Pritha-Kunti (King Kuntibhoj's daughter). King Pandu renounced throne. Five sons :Yudhishthir, Arjun, Bhim Nakul, Sahadev - came to be known as the Pandavas
MAHABHARATA WAR (between Kauravas and Pandavas) Pandavas victorious with Krishn on their side
Yudhishthir coronation Onset of YE calendar from February, 3140 BCE

Figure 3.2: Abridged genealogy of the Kuru-dynasty within the Lunar- line.

Dhritrashtra was married to the princess of Gaandhaar (present name Kandahar in Afghanistan) which was ruled by King Subal. Dhritrashtra's queen being from Gaandhaar her historical name is Gaandhaari, meaning 'the one from Gaandhaar'. Dhritrashtra had many sons: Duryodhan, Dushasan … all younger to Yudhishthir, the oldest son of Paandu. Being the descendants of Kuru the sons of Dhritrashtra were called the Kauravas while the five brothers born of Paandu, also in the Kuru dynasty were addressed as Paandavas (born of Paandu).

The Paandava princes were known for their ideal character, ability and valor and the Kaurava princes were known for atrocities and misuse of power. The Kauravas felt threatened that at anytime or after their blind father died, the Pandavas, being the legitimate heirs to the throne of Hastinapur, would naturally assume the throne. This led to conflicts between the Kauravas and the Pandavas; initiated by the Kauravas. The Kauravas hatched numerous conspiracies to eliminate the Pandava princes and failed. To resolve the conflict, the grandfather Bhishm, the blind King Dhritrashtra, the military generals, the emperor's political advisors and diplomats decided to give the Pandavas the ownership of half of the Kuru kingdom.

The area of the kingdom given to the Pandavas was uninhabitable, covered with thick forest. The Pandavas with the help of Krishn and his brother Balram studied the lay of the land and after determining a suitable area for establishing the new capital for the new kingdom for the Pandavas, they requested the most respected scholarly Rishi Badrayan Vedvyas (Mahabharata, Aadi-parv, 34/34) to conduct the auspicious ground-breaking ceremony, to survey and measure the land and design the capital. The book of Mahabharata is arranged in sections called *parvs*, each parv having a number of chapters and each chapter has a number of shloka-couplets in it. The masterful strategic design of the city, its architecture and beauty are described in the chapter 34 of the Aadi-parv of Mahabharata in shlokas 35 through 49. The shloka 41 states that this 'heavenly city' at the shore of River Yamuna was named "Indraprasth", which meant - "the arrival of the most powerful king". Indraprasth was located in the area of modern Delhi, the present capital of India. Indraprasth continues to serve as the capital of the Lunar Dynasty after Yudhishthir.

The Kaurava princes being immoral and greedy wanted it all and continued conspiring against the Pandavas and unscrupulously managed to uproot them from their new capital at Indraprasth. The Pandavas prepared for war to take back what was rightfully theirs but the Kauravas did not budge. Yogiraj Krishn went to negotiate with the Kauravas and requested them to give Pandavas some land for them to at least settle down in their ancestral kingdom. Krishn in his meeting with the Kauravas advised them to avoid war which would always result in death and destruction. To keep all the land for themselves the oldest Kaurava Prince Duryodhan rejected Krishn's request and advice and also rejected the advice from his own father Dhritrashtra, mother Gaandhaari, Grandfather Bhishm and many scholarly people in the court. Duryodhan chose to go to war. While rejecting Krishn's request, the Kaurava Prince Duryodhan arrogantly said to him what is now a common expression among the Hindus when a similar situation arises - "*We will not give any land to the Pandavas - not even equal to the tip of a needle*". With Yogiraj Krishn's efforts wasted, the kings of entire Bharatvarsh began to envisage the conflict escalating into a war between the righteous and the evil. It ultimately led to the Mahabharata War. This war between the cousins became a war between "the good" and 'the evil'; the Pandavas being the good and the Kauravas being the evil.

Mahabharata War, primarily about the disagreement on the division of the kingdom, pulled in a large number of kings of Bharatvarsh, some taking sides with the Pandavas and others with the Kauravas, a scenario quite similar to the World War II of modern times. Krishn, who had moved his capital from Mathura to Dwarka in the present Gujarat

State, vowed not to take direct part in the war, however, he chose the side of the righteous Pandavas and decided to be only a charioteer for Prince Arjun. After the rules of engagement for the war were finalized the war was inevitable. When Arjun arrived at the Battle-field of Kurukshetra in his war-chariot driven by Krishn, he realized that the unavoidable war loomed over the extended family and unmitigated destruction awaited. He expressed his innermost thoughts to Lord Krishn saying that this war was not worth fighting because his own cousins and dear ones would be killed. Krishn advised Arjun that it was no longer a war between cousins but that this conflict was a war between righteousness and evil and therefore he had no choice but to fight for righteousness. Krishn gave a sermon to Arjun about the importance of karma, duty to the society and the philosophy of life. This sermon at the battle-field is known as the Bhagvadgita. Arjun was convinced and became ready again to take part in the battle. The Kauravas were destroyed by the Pandavas in the Mahabharata War. Yudhishthir already known as the Dharmaraj (a righteous king, following dharma) was enthroned at Hastinapur. Yudhishthir's coronation was marked by the onset of a working calendar known as the Yudhishthir Samvat (Yudhishthir Era, YE) 38 years prior to the milestone at February 18, 3102 BCE which is the onset of the Kali-Yuga calendar within the Srishti-Calendar (Natural Aryan Calendar).

The present day Hastinapur town is in the state of Uttar Pradesh about 100 km north of Delhi. The Mahabharata War was fought on the plains of Kurukshetra, west of Hastinapur, west of River Yamuna, which is about 160 km north-west of Delhi. This war is also known as the Kurukshetra War.

Beginning in 3140 BCE Yudhishthir ruled for 36 years 8 months and 25 days and abdicated the throne to proceed to the Himalayas for meditation. From Yudhishthir onwards the Aryan kings ruled successively at Hastinapur and later at Indraprasth till the rule of the last Aryan King Yashpal was ended in 1192 CE by the Moslem invasion. Based on historical records found in Sanskrit Literature, Swami Dayanand Sarasvati has listed in the Satyarth Prakash the unbroken succession of Aryan Kings at Indraprasth. These data are presented in Table 3.3. From there on the change in the Mahabharata War rule at Indraprasth from Aryan rule to Moslem rule also brought the change in the name of Indraprasth to Dilli. The history of the Moslem rule at Dilli is well-known and it is also well-known that Dilli under the British rule changed again to Delhi. The present capital of independent India is situated in New Delhi.

The Marker-4 at 3140 BCE on the Timeline-A (Figure 3.1) also represents Lord Krishn and his pre-war sermon of Bhagvadgita to Arjun at the battle-field of Kurukshetra. This is also the period when the last two of the 6 Vedic Darshans (philosophies), the Meemansa Sutra by Rishi Gautam and the Vedanta Sutra by Rishi Vedvyas were written. Krishn, just before Mahabharata War had moved his capital from Mathura to Dwarka, establishing a new kingdom in the area now part of the Gujarat State. Dwarka is at the shore of the Paschim Saagar (ancient name of Arabian Sea). Sometime after Krishn's death near the onset of Kali -Yuga epoch in 3102 BCE, tectonic activity submerged the city of Dwarka in the sea. Under the national heritage program, the Indian archeologists and geologists of the Geological Survey of India have recently discovered and mapped the submerged ancient city of Dwarka. Dwarka continues to be a national heritage site

and a pilgrim place for the Hindus. It is the reestablished Dwarka town at the shore of the sea where the brilliant monk Aadi Shankaracharya established an ashram (Matha) in October 492 BCE when he was only 17 years old. The Marker-6 on the Timeline-A in Figure 3.1 reflects Aadi Shankaracharya's historical significance in the Indian Civilization. The Matha that he established at Dwarka still continues to function as a seat of learning. In February 2014 it was a moving experience for this author to see some of Aadi Shankaracharya's personal items like his wooden foot-ware in the Shankaracharya library at the Dwarka Matha.

There is no dearth of recorded history in the ancient Sanskrit Literature. When one goes into the far antiquity of the Vedic Civilization beyond 3140 BCE (Timeline-A, Marker-4) one finds the history of the Solar Dynasty that started with King Manu who established the city of Ayodhya in the ancient region of Kosal. Rishi Valmiki authored Ramayana, the biography of King Ram, a descendent of King Manu. Rishi Valmiki in Ramayana has provided a substantial list of the names of kings in King Manu's genealogy. All this further tells us that the Aryans have been in India since the beginning of their Civilization in the far antiquity. The dotted block in Figure 3.2 pertains to the Solar Dynasty. It has been a tradition in India, which the Western scholars were not aware of, that the historians and pundits were appointed by the kings to record the history of their region. Therefore, in addition to describing the genealogy of kings there is a geographical description of the region that a king governed. A brief mention of the Solar Dynasty is made in Chapter 4 under Smriti and Ramayana. A brief genealogy of the kings in the Solar Dynasty of King Manu is presented here.

According to the ancient Indian tradition, a marriage is not only between the young couple but also between the two families. As a part of this tradition the members of the two sides are introduced to each other at the wedding ceremony and the genealogies of both sides are recited by the respective family priests. This tradition first cited by Rishi Valmiki in Ramayana, continues in traditional wedding ceremonies in modern day India. At the wedding of Prince Ram to the Princess Sita, the genealogies of the two kingdoms, Ikshvaku-kingdom (named after King Manu's son Ikshvaku) of Ayodhya and Janak-kingdom of Aryavart's Mithila region, were recited. The *Raj-purohit* (royal-priest) Vasishtha of the Emperor Dashrath (Ram's father) recited the genealogy from King Manu to King Dashrath and in the place of the *Raj-purohit* Shatanand of Mithila Kingdom, Sita's father himself, the learned King Janak known for his deep knowledge of the Vedas, recited Sita's side of the genealogy.

These genealogy-recitations in the court of King Janak are part of Valmiki-Ramayana. Rishi Valmiki has devoted 36 *shlokas* in the Baalkaandam chapter's 29$^{th}$ *sarg* (section) to cover 34 names of the kings in the Solar Dynasty from King Manu to King Dashrath. In the next *sarg* he has devoted 15 *shlokas* to cover 23 names of the kings in the Mithila-kingdom, beginning from the King Nimi to King Janak. In the Table 3.1 are listed the names of the kings in the Solar Dynasty only. King Vrihadbal, the last entry in the Table 3.1, was contemporaneous to the Mahabharata period in 3140 BCE. Rishi Valmiki's Ramayan and King Ram being well before the Mahabharata period, King Vrihadbal of course is not listed in Ramayana in the Solar Dynasty genealogy recital by the Royal Priest Vasishtha.

Even though the Puranic rituals prevail in the present Hindu society, the basic societal structure continues to function within the laws of Manusmriti and Hindus continue to consider King Manu to be the founder of the Vedic/Hindu society. Whether a Hindu is a ritualistic Puranic or a worshiper of the formless God, a Hindu believes that Manu's Manusmriti is very ancient and Valmiki Ramayan and Mahabharata respectively are historical accounts respectively of the Solar Dynasty and the Lunar Dynasty. Manu, Ram and Krishn for the Hindus have been historical figures, in that chronological order, separated by centuries and eons, who brought great transformation in the Aryan society. The books such as Manusmriti, Ramayana and Mahabharata are historical accounts in that chronology.

**Table 3.1: Abridged Genealogy of Aryan Kings in the Solar Dynasty of King Manu (Valmiki Ramayana, Baalkaandam, 29/1-36).**

| | King's name | | King's name | | King's name |
|---|---|---|---|---|---|
| 1 | Manu | 13 | Bharat | 25 | Agnivarna |
| 2 | Ikshvaku | 14 | Asit | 26 | Shighrag |
| 3 | Kukshi | 15 | Saagar | 27 | Maru |
| 4 | Vikukshi | 16 | Asmanj | 28 | Prashushruk |
| 5 | Baan | 17 | Anshumaan | 29 | Ambareesh |
| 6 | Anranya | 18 | Dileep | 30 | Nahush (Just and virtuous) |
| 7 | Prithu | 19 | Bhagirath | 31 | Yayati |
| 8 | Trishanku | 20 | Kukutsth | 32 | Naabhaag |
| 9 | Dhundhumaar | 21 | Raghu | 33 | Aj |
| 10 | Yuvnashva | 22 | Pravridha (Kalmashpaad) | 34 | Dashrath |
| 11 | Mandhaata | 23 | Shankhan | 35 | Ram (three |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | **step brothers: Lakshman, Bharat, Shatrughn)** |
| **12** | **Susandhi, Prasenjit** | **24** | **Sudarshan** | | **…… ……** |
| | | | | | **King Vrihadabal (in 3,140 BCE)** |

Western scholars accept that the Hindu society's basic rules are from Manusmriti, whenever it was written. Then there should be no difficulty in accepting Manusmriti's geographical map of the place of the Aryans/Hindus. When we look at Manu's geographical description of the place of the Aryans (to be discussed), we find no place else but India as the home country of the Aryans. It was intellectual dishonesty on the part of Max Muller et al. who disregarded Manu, his genealogy and his geographic description of the place that he ruled. On top of that, supporting the rootless Aryan Invasion Theory (AIT, discussed in the following) concocted behind closed doors in England by some ignoble ignorants is further proof of this intellectual dishonesty.

Accepting Manu's geographical map of Aryavart and his description of its inhabitants and those outside the borders of Aryavart render AIT defunct. Manu and Manusmriti are variously referred to in the book of Mahabharata and in the post-Veda ancient literature preceding the Mahabharata War and indicating that the Aryans of India are the native people of India from antiquity. Rishi Vedvyas the author of the book of Mahabharata is also the author of Vedanta Sutra and the interpreter of Rishi Patanjali's Yog Sutra and other books, all of which are a reality of the historical period around 3140 BCE. The genealogies of Figure 3.2 and Table 3.1 are not fictional.

This was also the period in the history of Aryavart when the *guru-shishya parampara* (guru-student Vedic tradition) prevailed with high literary achievements against the backdrop of the simplicity of Rishi Vedvyas's ashram. It was Rishi Vedvyas's first senior student, Rishi Jaimini, who completed his Meemansa Sutra before his guru completed Vedanta Sutra (see Table 4.2 in Chapter 4). The other three senior students of Rishi Vedvyas according to Vishnupuran (3/4/7-18) were Sumantu, Pail, Vaishampayan; the latter two continued teaching other students who are also named in the Vishnupuran (from "Vedant Darshan ka Itihaas", by Udayaveer Shastri). The completed book of Mahabharata in poetry was presented by Vaishampayan the third student of Rishi Vedvyas, to the Aryan King Janmejaya of Hastinapur (Delhi), the great-grandson of Arjun. All these scholarly people with their literary works that the Indians cherish today, cannot be termed fictitious and discarded for a fictitious AIT for which there is no evidence in the Aryan literature, history or the Puranas. The Mahabharata War was between the Aryan cousins. There never was an invasion of India by the Aryans of Asia Minor, as imagined by the proponent of AIT - Maxmuller et al. If the Aryans had come from some place outside of India, the literature that they created would have at least one

mention somewhere to that effect. The Aryans known to be prolific in expressing their thoughts could not have had a memory lapse and forgotten their native place, Asia Minor or elsewhere.

Commonsense dictates that in an invasion of a country by a group of people only a limited number of invaders take part in the attack. When invaders have come to India, for example the Greek/Armenians with Alexander in the fourth century BCE or the Moslem invaders from 1192 CE onwards, only a limited number of men soldiers have come to invade and not the whole population of the invading country. A large part of the population of the invading country is left behind to carry on the business of that country. The invading militaries do not bring en masse their teachers, scholars and philosophers. Rather they are generally left behind where they are more useful to carry on with their duties in the areas of education and culture. There are no regions on the Earth other than India where the highly developed Sanskrit language, considerable Aryan culture and the ancient voluminous Sanskrit Literature exist. Neither in this vast Sanskrit Literature nor in the Indian folklore is any fleeting reference to be found of Aryan's coming from someplace else. On the other hand the overwhelming numbers of references that one finds in the ancient Vedic Literature indicate that India has been the place of the Aryans from as far back as antiquity. In the German culture and language there is considerable influence of Sanskrit and the Aryan culture. It is strange that Max Muller, himself a German, did not apply the same AIT to Germany first; that the Aryans invaded Germany as well!

The Aryans cremate their dead. This practice is not blindly followed by the Aryans because the Veda advised them to do so. It is because in their philosophic development they understood the meaning of death and the reality of matter and consciousness and the inherent separation between the two. This unique cremation practice is not found in other European enclaves. It is offensive for a foreigner to say that the Aryans of Aryavart were intruders in their own homeland. The Genome Project, discussed later in this chapter, will put an end to this insult that has prevailed for a century and a half.

## Time-Milestone at February 18, 3102 BCE
(Marker-5 in Figure 3.1)

The Srishti Samvat of the Aryans is a natural calendar that relates to astronomy rather than to the birth of a well-known person or to a coronation of a great king as in the case of the Yudhishthir Samvat, Vikram Samvat or the Christian Era. The term *srishti* means the 'creation of the universe' and *samvat* means the calendar year. The Srishti-calendar therefore represents the number of years elapsed after the creation begins functioning and the solar day becomes meaningful. In other words the Srishti Samvat represents the establishment of the solar system. More discussion on the Srishti Samvat is in Chapter 5. A sub-calendar within the Srishti Samvat represents the onset of a shorter cyclic epoch of a specific length known as a Yuga. As this author has understood it, the onset of the sub-calendar relates to the solar system and the astronomical position of the

planets. The **Marker-5** on the Timeline-A (Figure 3.1) represents the onset of such an epoch, called Kali-Yuga. The duration of a Kali-Yuga is 432,000 Earth-years after which another epoch and sub-calendar within the main Srishti-calendar will commence with another Yuga name with a different duration. The Kali-Yuga begins in the 38$^{th}$ year of Yudhishthir Era (YE). The historical records after the onset of the Kali-Yuga calendar show that from there on the Vedic society has used the YE and the Kali-Yuga Era calendars in parallel. In the context of historicity, only limited astronomical details related to the calendars are presented here.

The onset of Kali-Yuga is stored in the time division of *din, muhurt, ghatka, kalaa, kaashtha* and *nimesh,* where *din* is a solar-day (day+night) and the *nimesh* is 8/45$^{th}$ of a second. As Swami Dayanand Sarasvati had expressed - the Aryans have been tracking the calendars by adding the days and years to the onset of Kali-Yuga and therefore to the composite *Srishti Samvat*, in the same way as *the ledgers are kept by accountants*. For example the accurate onset of Kali-Yuga in terms of popular units was on **February 18, 3102 BCE at 2 hours 27 minutes and 30 seconds**. This serves as the base for all future calculations. Additionally the planetary positions near the *yog-taara* (identifying star) of the Vedic constellation named Revati are stored for the six planets - Saturn, Jupiter, Mars, Venus, Mercury, Moon (including both of the Moon's opposite nodes - northern (*Rahu*) and southern (*Ketu*)) and the Sun. These astronomical data are recorded with the accuracy of *raashi, ansh, kalaa* and *vikalaa,* which in the terminology of modern astronomy respectively are: the count of the zodiac sign, and the angle in degree, minute and second. There are 12 zodiac signs as in the Western astronomy each subtending an angle of 30 degrees out of the 360 degree circle. Of the 28 Vedic named constellations the Revati (AtharvVeda, 19/7/5) with its 32 stars appearing in the shape of a fish has its identifier star (*yog-taara*) same as the *Zeta Piscium* in modern astronomy.

Observed from the Earth, like all planets, the Sun is also observed moving through the constellations within the central bend of stars called the zodiac. The Sun's apparent path through the zodiac called the ecliptic is not parallel to the celestial equator of the celestial sphere (night-sky dome); rather it is tilted showing the Sun above it for half the year and below it for the other half. The star *Zeta Piscium* representing the Revati constellation falls right on the path of the Sun in the zodiac.

These astronomical data are based on the observations made by ancient *rishis*. The astronomical data with mathematical methodology for calculating astronomical details are successively passed on to the scholars of astronomy groomed in Vedic learning centers. The calendars are prepared based on accurate calculations with predictions of the dates and times of festivals and celebrations most of which are related to astronomy and Nature. In the present day India the same calendars and almanacs are also used by astrologers to determine the planetary positions for astrology.

It is well-known in the history of modern astronomy that the written copies of the astronomical data recorded by Indian astronomers reached Europe in the 18$^{th}$ century. When these data were put to the test by well-known astronomers of the time, Jean-Sylvain Bailly (1736-1793 CE) and John Playfair (1748–1819 CE), they found that the recorded planetary positions corresponding to the onset of Kali-Yuga on **February 18,**

**3102 BCE** were within the accuracy of 37′ (minutes of an arc) which is about 0.6 degree angle. Vedic astronomy is a subject by itself that cannot be explored fully in this book. Relevant information on this however is included in Chapter 11 in Volume 2.

Now, the question – why exactly is this date established for the onset of the period called Kali-Yuga with the ensuing sub-calendar within the natural calendar of the Aryans? More details on the time division of the Aryans, in terms of the *yuga* periods in million and billion years on the higher side of the time scale and the unit of *nimesh* on the lower side, up to the fraction of a second, are given in Chapter 5 under the sub-heading of '*Kaalah-Tatva*: the Time-Entity'. Here a brief discussion is presented on how the Aryans arrived at this milestone on the timeline of their history.

## Kali-Yuga onset and the Planetary Conjunction

The Vedic cosmology/astronomy principle upholds that all planets of the solar system, at the beginning of the creation, start their orbits around the Sun at the same time, from the same direction in space from the Sun. The creation in this context is primarily the creation of the solar system when the planets including the Earth are in orbit around the Sun. A day for the Earth is defined by the Earth's spin around its axis and a year by its revolution around the Sun. Therefore the creation in this context is the onset of the solar system. In fact this Vedic principle is not too far off from the modern theory of the formation of the solar system itself where an explosion on the Sun throws out in space a blob of matter that cooled and coalesced into different planets. The physics also tells us that this blob of matter under the gravity of the spinning Sun carried with it enough angular momentum for planets to spin and orbit around their progenitor the Sun. Therefore, the Vedic premise that all planets began their orbital journey around the Sun from the same space and time is after all a piece of science and not religion.

The Vedic astronomy principle further stipulates that based on their period of revolution, all planets orbiting around the Sun, position themselves in different constellations at different times (Surya Siddhant, 1/25-27). When a planet starts from a constellation say, Revati, and arrives back at the same point in Revati, it completes one *bhagan* (orbit). Different planets over a long period of time complete many *bhagans*. Over a period of 4,320,000 years all planets are said to have completed different number of full *bhagans* such that they all are aligned pointing in Revati constellation at the same time. This astronomical phenomenon is well-known as the conjunction of planets. The period of 4,320,000 years when all planets completing the exact number of their *bhagans* (orbits) return back into the same constellation at the same time of the year, is a derivation indigenous to Vedic astronomy. This period of 4.32 million years is called a Maha-Yuga. A Kali-Yuga period is one tenth of a Mahayuga when there is a partial planetary conjunction. Over the centuries from time to time there are always partial

planetary conjunctions. With sophisticated computer algorithms in modern astronomy one can now predict or do back-calculations for conjunctions.

What is mind-boggling here is the periodicity discovered and established by the Vedic rishis that could not have been possible, as the European astronomer Bailly had remarked, without actual accurate astronomical observations of all planets including the Sun in the background of previously well-defined constellations. Such a planetary conjunction also defines the onset of the present Kali-Yuga epoch that commenced on **February 18, 3102 BCE** at the milestone at Marker-5 on the Timeline-A in Figure 3.1.

It is these astronomical data that went to Europe from India and were examined by the famous astronomers, particularly by the French astronomer Bailly (1736-1793) who confirmed their accuracy and remarked– "*...The calculation of Brahmans is so exactly confirmed by our own calculations that nothing but actual observations could have given so correspondent a result…* " (in "The Theogony of the Hindus", by Count Bjorustjourna, Pub. John Mu, London, 1844, p.82; taken from "Aryon Ka Aadi Desh Aur Unki Sabhyata" by Swami Vidyanand Sarasvati, Published by International Aryan Foundation, Mumbai, 1989). More details about the time-division of the Aryans is in Chapter 5, however, it would suffice here to say that the onset of the present *Kali-Yuga* marks the beginning of the *Kali-Yuga* Calendar.

## Other Historical Markers on the Timelines

A discussion on the period of the Vedas and Manusmriti from the perspective of Max Muller et al. is included in Chapter 4. Max Muller in particular had placed the Vedas as shown on Timeline-B (Figure 3.1) at Marker-1B (1500 BCE) and Manusmriti (MS) at Marker-2B (300 CE). The Marker-6 at 509 BCE on Timeline-A was also placed by Indologists at Marker-6B at 788 CE. In the analysis that follows, all Markers on the Timeline-B will be proven wrong and those on the Timeline-A will be proven correct.

The Marker-6 on Timeline-A represents the advent of Aadi Shankaracharya, the great thinker, philosopher and the proponent of *Adwaita-Vedanta* (the philosophy of non-dualism). Aadi Shankaracharya at the Marker-6 is an important milestone in Indian history. Recall that this is the time when young Shankaracharya took it upon himself to preach against the atheistic and agnostic religious sects in the Vedic society at that time, Buddhism and Jainism included. He toured India from south to north and east to west, challenged Buddhist and Jain philosophers for public *shaastraarths* (debates), defeating them every time. The rule of engagement for these *shaastraarths* was that the defeated person will convert to the winner's religion. These *shaastraarths* therefore led to the conversion of prominent Buddhist and Jain philosophers, kings and general masses, back to Vedic religion (now known as Hinduism). During his travel he established four Mathas (monasteries) at four corners of India. They are since known as Shankaracharya's Mathas which continue to be highly revered ashrams and the seats of learning even now after two and a half millennia. In the Matha tradition, established by Aadi Shankaracharya himself, a learned and dedicated person is appointed as the figure-head of the Matha to succeed

the previous figure-head. All figure-heads are addressed as “Shankaracharya”, whatever their birth names may be.

Western Indologists in their studies of Sanskrit Literature and Indian history shrank the Timeline-A into the Timeline-B (Figure 3.1) by theorizing that the advent of Manusmriti at Marker-2 and the Mahabharata War and the other historical personalities at the Marker-4 were all a myth. They also said that the important historical figure Aadi Shankaracharya existed well after the beginning of CE. The Western scholars not being fully aware of the Matha tradition that all care-taker Acharyas from Aadi Shankar onwards, till today, are also addressed as Shankaracharya, they placed Aadi Shankaracharya’s advent all over the place on the map after the beginning of the Common Era (CE). It was later narrowed down to somewhere in the 8$^{th}$ or mid-9$^{th}$ century CE and finally erroneously to 788 CE. This is shown by the Marker-6B on the Timeline-B.

Aadi Shankaracharya was a great person of national and historical importance. In the following it will be shown from the hard-core data at the Mathas that he was born in 509 BCE. Thus, looking at the difference between the Marker-6 on Timeline-A and the Marker-6B on Timeline-B one finds that even for this important historical event in Indian history the Indologists created a confusion of 1,300 years. Under such a situation if this author successfully establishes here that Shankaracharya’s advent was at 509 BCE (on Timeline-A) and relates this date and other specific dates in Shankaracharya’s life to Yudhishthir Era calendar, then Yudhishthir himself is proven to be a real historical figure and not a fictitious, mythical character as suggested by the Indologists.

The three calendars presently in use in India, two Hindu calendars and the third brought in by the British, are chronologically after the King Vikramaditya (57 BCE), Jesus Christ (0 CE) and the King Shalivahan (87 CE). These three were real people. The Indian history is as certain about the reality of the two Aryan kings as the rest of the world is about Jesus Christ. Yudhishthir-calendar was long in use in India, in which written records are available for the time period before the Kings Vikramaditya and Shalivahan. Yudhishthir-calendar continued for a long period along with these two later Aryan calendars. Under this situation, there is no sound logic for one to suggest that the King Yudhishthir was an imaginary figure.

The strong correlation between Marker-6 on Timeline-A at 509 BCE and the Marker-4 at 3140 BCE is shown in the following. One cannot separate King Yudhishthir from Yudhishthir Era calendar and one cannot separate King Yudhishthir from Mahabharata War and the contemporaneous existence of King Krishn, latter being for the Hindus what Jesus Christ is for the Christians. Based on the written historical records kept in Shankaracharya Mathas, the historicity of the King Yudhishthir, Yudhishthir-calendar and Mahabharata War is validated, thus validating Timeline-A.

Additionally the data recorded in yet another calendar, Kali-Yuga Samvat in parallel with the Yudhishthir calendar further validates all markers on the Timeline-A. The onset of Kali-Yuga Samvat cannot be disputed because it did not commence like another calendar. It did not commence at midnight or at sunrise at GMT (Greenwich Meridian Time), it commenced, as mentioned before, exactly at 2 hours 27 minutes and 30 seconds in GMT on February 18, 3102 BCE. This astronomy based calendar is as scientific as it

can get. While some Shankar Mathas have recorded succession history of care-taker Acharyas since 509 BCE onwards in the Yudhishthir-calendar with its beginning in February in 3140 BCE, the other Mathas have independently recorded the succession history of the care-taker Acharyas in the Kali-Yuga calendar with its beginning 38 years into the Yudhishthir calendar.

## History-Keeping in Aryan Calendars

History-keeping, on a short and long term basis has been ongoing in India using the social calendars as well as in the *Srishti-calendar* (Natural-calendar).

**Table 3.2: Indian Calendars**

| Calendar | In the Year 2018 CE | Comment |
|---|---|---|
| **Yudhishthir-Samvat (YE)** | **5158 (YE)** | **started from the coronation of King Yudhishthir at vernal equinox in 3140 BCE** |
| **Kali-Yuga Samvat (KE)** | **A+5120 (KE)** | **Natural sub-calendar (within *Srishti*-calendar) started on Feb 18, 3102 BCE. A is the accumulated number of years from the beginning of Srishti Calendar.** |
| **Vikramaditya Samvat (VE)** | **2075 (VE)** | **started from the coronation of King Vikramaditya of Ujjain at vernal equinox in 57 BCE** |
| **Shalivahan Samvat (SE)** | **1937 (SE)** | **started from the coronation of King Shalivahan of Ujjain at vernal equinox in 78 CE** |

Four Aryan calendars are summarized in Table 3.2. For example the Yudhishthir-Era (YE) in the Common Era year of 2018 CE was 5158 YE (3140 BCE+2018 CE = 5158 YE). The relationships between the other three Aryan Calendars and the Common Era are also shown in the Table 3.2.

The Vikram Samvat started from the time of the coronation of the great King Vikramaditya of Avantika (present name Ujjain) on March 22, 57 BCE. The onset of Vikram Samvat/Era (VE), 57 BCE, is shown by the Marker-7 on the Timeline-A (Figure 3.1). The Shalivahan Samvat/Era (SE), popularly known as Shaka Samvat, started 135 years after VE with the change in the dynasty at Ujjain. It began in the Common Era 78 CE. Although computer softwares are available now to prepare Hindu (Vedic) calendars with predictions of important dates and festivals, the Indian system based on Surya

Siddhant (Sun Principle) is still followed for preparing the *panchangs* (five-limbed almanac/calendar) for Hindu festivals and celebrations in both the VE and SE calendars.

The five limbs of the *panchang* are: (1) *Tithi* (lunar phase: a 12° sector between the Moon and the Sun, total 30 sectors); (2) *Nakshatra* (one of the 27 constellations wherein the Moon is observed from the Earth: a named angular sector width of 13°:20´); (3) *Yog* (degree of conjunction between the Sun and the Moon: 1 Yog is equal to 13°:20´); (4) *Karana* (the angle of a half *Tithi*: 6° between the Sun and the Moon) and (5) *Vaar* (solar-day of the week). The ancient introduction of the five-limbed calendar into the Vedic society itself points to the fact that the Indian astronomy was highly developed from antiquity. Obviously the five-limbed Indian calendar is more detailed than the Common Era calendar. This is indicative of the level of civilization of the society. The ancient records of history and historical events recorded in VE and the two other Vedic calendars older than VE will further help prove the 'Vedic Reference Hypothesis'. It is also informative and instructive to look at some features of the Common Era (CE) or the Christian calendar, also known as the Gregorian calendar.

In the Vedic system there is a unique connection between astronomy and the names assigned to the months of the year. This uniqueness distinguishes the Vedic/Hindu calendar from the other non-Vedic calendars, for example the nomenclature of the months in the CE calendar has no relation to astronomy. The other striking difference between a Vedic calendar and the CE calendar is a shift of about two months in the start of the year. The year in the Vedic calendars begins in the month of March.

## Christian Calendar Discrepancy

This author finds the Common Era/Christian Era (CE) calendar a mixed-bag of names and numerals for the months and provides an interesting insight into the development of the CE calendar and its possible ancient connection to the Vedic astronomy.

Not many people may have noticed that some of the successive names of the months in the CE calendar are based on numerals. For example, the months of September, October, November and December have the names of Sanskrit numerals. This becomes obvious when the common suffix of 'ber' is dropped from each of the names. Without the suffix the names of these four months are: Septem-, Octo-, Novem- and Decem- . The Sanskrit pronunciation for the numerals 7, 8, 9 and 10 respectively are*: saptam, ashtam, naval* and *dasham*, which sound very close to the prefixes of the names of these months in the Common Era calendar : Septem-, Octo-, Novem- and Decem-. This indicates a possible historical connection between Sanskrit and the names of these months. However, the fact is that these months are: $9^{th}$, $10^{th}$, $11^{th}$ and $12^{th}$ in the CE calendar and not $7^{th}$, $8^{th}$, $9^{th}$ and $10^{th}$ as the Sanskrit names of the numerals indicate. Therefore there is a two month shift in naming the months in the CE calendar with respect to the Vedic calendar. In addition to a two month shift in naming the months in the CE calendar there is about a two month shift in the beginning of the year as well. *Chaitra* is the $1^{st}$ month of the Vedic

calendar which begins around March 22 and ends in March. So there is a shift of about two and a half months between the two calendars.

Looking at the above mentioned dual discrepancy, this author formulates a deduction here as:

> "*Due to some historical reason the Christian Era (CE) calendar got shifted with respect to the Vedic calendar by two months without changing the names of the months.*" (Shiv Raj Pal, 2006)

Is there an ancient connection between the Vedic calendar beginning in March and the CE calendar beginning in January? Yes there seems to be and to check this let us begin with the definition of the terms 'day' and 'night' in the two calendars. By definition the term 'day' corresponds to a bright period with sunlight and the term 'night' corresponds to the dark period with the absence of sunlight. The idiosyncrasy of the CE calendar is that the names of the seven days of a week are hyphenated by the word 'day' (e.g. Sun-day, Mon-day, ….), while the day in CE begins at midnight which is in the middle of the dark period. Logically, if the beginning of a day is at midnight it would be logical to call the days as Sun-night, Mon-night and so on.

Within the contiguity of the bright and dark periods in a day, a complete-day is defined to be of 24 hours duration. The complete-day in the CE calendar is made up of a day (with light) plus two different half-nights. For example, a Sunday is made up of 12 hours with half-night leftover from the Saturday, plus the daytime of Sunday, plus the half night of Sunday. The question is - why split the night at midnight and call it a day while it is still night? This does not seem logical and is far from being scientific. In the Vedic system on the other hand the day begins at sunrise when the day-light begins and the night starts at sunset, when the darkness begins; a very logical delineation. In the CE calendar therefore in addition to the shifted serial numbers of the months and the month-misnomers, now we also have to worry about the split of two nights around a complete-12 hour day. A most likely reason for this miscellany in the CE system is discussed below.

The day change in the West begins at midnight at the Greenwich zero longitude, in England. Is there a direct correlation between the sunrise in India and midnight at Greenwich meridian? Just as in Yudhishthir's time the ancient city of Hastinapur at the geographical coordinates (28.4° N, 77.2° E) was prominent, the city of Ujjain at the geographic coordinates at (23.2° N, 75.77° E) came into prominence with the Emperor Vikramaditya. Vikramaditya had established a highly scholarly environment. It is said that he sent out scholars to teach math, science and Vedic philosophy when requested by the kings in the Middle-Eastern regions. Ujjain's prominence continued with Brahmagupta (598-668 CE) who headed the astronomical observatory at Ujjain and wrote in 628 CE the text on astronomy, entitled "Brahmasphuta-siddhanta". Down the line yet another astronomer Bhaskara (1114 - 1185 CE) headed the astronomy observatory at Ujjain and wrote the text entitled "Siddhantashiromani" in two parts, "Goladhyaya" that deals with "mathematics of spherical bodies" and "Grahaganita" which deals with the "mathematics of planetary orbits".

With this background in place let us check if there is a correlation between the prominent city of Ujjain and Greenwich. Presently, the geographic longitude of a place is determined with respect to the zero longitude at Greenwich. Of the 360° longitudes covering the entire globe, the coordinates of a place are expressed as 'degrees east of Greenwich' and 'degrees west of Greenwich'. The 360° of longitude are equivalent to 24 hours; 15° per hour. The time zone of a place is therefore determined in hours-east or hours-west, depending on what longitude in the east or west of Greenwich the place happens to be. Since the longitude of a place determines the time zone of that place, the time difference between two places relates to the longitudinal difference between those two places.

The longitude of Ujjain with respect to Greenwich being 75.77°E, the time difference between Greenwich and Ujjain is 5 hours and about 3 minutes. The first day of the first Vedic month of Chaitra about 14 days before the spring equinox, marks the beginning of the Vedic year on March 10th. Let us look at the time difference between the sunrise at Ujjain, say for March 10, 2012, and midnight at Greenwich for the same day. The night of March 10 being about 13 hours and 28 minutes long at Greenwich the difference between the midnight (zero hours at Greenwich) and sunrise at Greenwich, is close to 6:44 hours. The sunrise time on March 10, 2012 at Ujjain is 06:40 AM. This is the time when the first day of the Vedic calendar begins at sunrise in Ujjain and at the same time the first day of the Vedic calendar begins at midnight at Greenwich. This means that when it is sunrise in India and a new day begins in the Vedic calendar it is very close to midnight in Greenwich and the same new day begins there, even though it is still in the darkness of night.

Due to the latitudinal change in the solar position during the year, the length of night and day changes during the year at all places on the globe. In spite of this, there is a strong correlation between the beginning of a day at midnight in the West at Greenwich and the beginning of the day with the sunrise in India. As mentioned before, it is logical to have the beginning of the day with the sunrise; the Vedic definition is more meaningful than the Western definition of the day where the day begins in the darkness at midnight at Greenwich. However, it seems that the definition of the day in the West with its beginning at midnight at Greenwich, did not begin arbitrarily or in isolation, rather it began in order to synchronize it with the more meaningful Vedic definition. This synchronization with the Vedic calendar was at the cost of splitting the night; half night to go with one day and the other half to go with the next day. This author's attempt to resolve the *Christian Calendar Discrepancy* is as in the following statement:

> *"There is a high likelihood that the Common Era (CE) calendar was influenced by the Vedic calendar. The influence of Sanskrit in the names of the months and their count is obvious but with an error of two month-shift. To keep a link with the commencement of the day with sunrise in the Vedic calendar the followers of the CE calendar began their day at midnight. The correlation between the two calendars indicates the possibility of migration of the scholarly between Aryavart and Europe when exchange of culture and language took place."*

# Defunct Aryan Hypothesis (AH) and Aryan Invasion Theory (AIT)

It is discussed at length in Chapter 4 that the Aryans have been proficient in record-keeping and recording their history at different levels of the society. Contrary to this some Indologists put forward a misconception that the Indians were not good in recording their history and created new timelines for the Indian history (e.g. Timeline-B in Figure 3.1). The Indologists did not stop at that, they concocted the Aryan Hypothesis (AH) that there were two races in India. The Indians with lighter skin were Aryan invaders who settled primarily in North India and those with darker skin were the native Dravidians mostly in South India. Complementing AH was the Aryan Invasion Theory (AIT) that the Aryans in India are invaders from Asia Minor.

The AH was hatched behind closed doors on April 9, 1866 CE in a meeting of the Royal Asiatic Society of London, presided over by Right Honorable Viscount Strongfold (ref. Vidyanand Sarasvati, 1984, 1989). In that meeting Edward Thomas put forward the hypothesis that the Aryans from Asia Minor invaded the Dravidian natives of India and consequently there were two separate races in India. The implication of the AH and AIT was the British justification to colonize India just as the Aryans and other invaders had colonized India. The expected result of AIT was the division created between the people of North and South India and between the fair-skinned and dark-skinned Indians. This division continues to this day.

The Oxford Professor Max Muller present in the same meeting, never having visited India once in his entire life, gave legitimacy to this imaginary invasion hypothesis by assigning a historical period to it. To this he added that the Aryan invaders destroyed the Indus Valley Civilization around 1500 BCE which he related to the recently excavated Mohenjo-Daro and Harappan Civilizations. The immediate disagreement to the AIT came from several British authors of that time who had lived in India, had studied Vedic culture and literature and those who had participated in the excavation of the ancient archaeological sites. In spite of these disagreements the AIT continued to thrive with the added weapon of the 'divide-and-conquer' strategy.

The famous archaeologist of that time Sir John Hubert Marshall (1876 - 1958 CE), was appointed by the British government as the Director General of the Archaeological Survey of India who served at this post from 1902 CE to 1928 CE. Archaeological excavations under his supervision discovered two ancient cities of the Indus Valley Civilization, Harappa and Mohenjo-Daro. Although not a single piece of armament or any sign of strife between the assumed invaders and the presumed defenders was found in these excavations, the antithetic discovery by Marshal did not deter the AIT proponents. Marshal expressed his disagreement with Max Muller's Aryan invasion date

of 1500 BCE and said that if there was an Aryan Invasion it could be somewhere between 2700 BCE and 3200 BCE. Even these dates proposed by John Marshall were offered without any substantiating evidence. So the date of AIT swung between 1500 BCE and 3200 BCE. One reason why Max Muller remained adamant about his suggested date of the Aryan invasion being near 1500 BCE could be to save another of his baseless hypothesis that the writing of the RigVeda and the arrival of the Aryans were not older than around 1500 BCE. Such was the pathetic wisdom of these professors and self-appointed historians. But the cat was out of the bag. There are those who still consider the word of a Westerner to be carved-on-stone and therefore the AIT continues in spite of massive evidence against it piled on by written historical records, new archaeological finds, carbon-dating and finally from the recent genetic research under the national Genome Project proving beyond doubt that the inhabitants of India, from north to south, are indigenous to India. If nothing else, the new results from the state-of-the-art genetic research, discussed at the end of this chapter, have put the last nail in AIT's coffin.

To prove the Vedic Reference Hypothesis that the mantra references on Vedic cosmology are older than 3140 BCE it is imperative to prove that the milestones on Timeline-A are real. This makes it necessary to shed some light on the AIT's dictum.

When a negative correlation between the development of Vedic Literature and AIT was pointed out by the indigenous Sanskrit scholars, the proponents of AIT insisted that the invading Aryans first settled in North India and then developed the rich Sanskrit language and then started creating Veda mantras and then established the tradition of learning and reciting them as the time progressed through their Civilization and culture. When the mind-boggling complexity of the Sanskrit language, its highly developed grammar, vocabulary, its unparalleled poetic excellence and its vast literature stared in the face of the proponents of AIT, they found themselves on shaky ground because all this progress required a long and stable historical period. To achieve such cultural magnificence in a short time, the invading Aryans had to be successful military invaders as well as literary geniuses; that defies commonsense. To get around this dilemma AIT proponents proposed that the Aryans must have brought the Vedas with them. Throughout the vast Vedic Literature there is not one single mention of another region or place from where the Aryans of India came. On the contrary, the Vedic Literature is filled with geographic references of places on the Indian sub-continent where certain *guru-kulas* (centers of learning with resident guru and students) were situated which produced some renowned thinkers, writers and philosophers who created post-Vedic literary works. There are lineages of families and dynasties that indicate that the Aryans are residents of India only. Also in the Indian Sanskrit Literature one finds references indicating the travels of individuals from ancient India to other continents and accounts of some even returning home to narrate their experiences.

Marshall's date assignment for AIT near 3200 BCE, well beyond Max Muller's date around 1500 BCE does not lend validity to the imaginary AIT. Marshal's figure is close to the Indian historical event of the Mahabharata War, fought between the cousins in the same dynasty and not between the Aryans and Dravidians as proposed by AIT. The Mahabharata is very well recorded in the Sanskrit Literature; the validity of its period is

being proved in the following pages. The documented historical records as well as the astronomical sky inscriptions are used for this proof.

The book of Mahabharata giving a comprehensive account of the conflict is in fact a book of history. Yet in the book of Mahabharata there is no hint of any Aryan invasion or of the Aryans coming from elsewhere into India. On the contrary there are a number of references in Mahabharata indicating a continued stable Aryan Civilization in different regions of the Indian sub-continent, from centuries before Mahabharata, with lists of genealogies of the Aryan kings who ruled there. The ancient book of Mahabharata was not written with a foresight that someday it would come handy to discount a 19$^{th}$ century wild Aryan Invasion Theory. The book of Mahabharata compiled by Rishi Vedvyas and his deciples and submitted to the King Janmejay of Delhi soon after the Mahabharata War that ended in 3140 BCE. The Mahabharata War was fought in the field of Kurukshetra near Hastinapur (near Delhi). Both warring sides in this war addressed themselves as Aryans and no one was called Dravidian. The fact remains that the inventers and supporters of AIT did not read the book of Mahabharata or deliberately remained ignorant of this ancient book on ancient Indian history.

The fact that Manu and his book Manusmriti are cited a number of times in the book of Mahabharata but Manu's Manusmriti has no mention of Mahabharata and other contemporaneous historical personalities like Krishn, Arjun, Yudhishthi and Rishi Vedvyas the author of the sixth Darshan, Vedanta Sutra. Manusmriti is older than Mahabharata. When Max Muller places Manusmriti after 300 BCE, he has to place Mahabharata after 300 BCE as well. In the ancient Indian history, the authors of the original book of Mahabharata, not counting the recent insertions, indisputably are Rishi Vedvyas and his students. Max Muller therefore puts Vedanta Sutra and his author Rishi Vedvyas's period later than 300 BCE.

The period of 300 BCE in Indian history is well-known where there is no sign of Vedvyas. Buddhism and its *sutras* existed well before 300 BCE which Max Muller had read and translated. Manusmriti, Mahabharata and the vast Buddhist literature do not have any indication of an Aryan invasion. Max Muller was perhaps not aware of the genealogy of the King Manu, that his son Ikshvaaku was the first King of Ayodhya after it was established by Manu himself. Muller was not even aware of Manu's Sun-dynasty at Ayodhya, listed in Valmiki Ramayana, nor was he familiar with the genealogy of kings in the Lunar Dynasty that ruled from Hastinapur and listed in the book of Mahabharata starting with King Shantanu. Neither Ayodhya nor Hastinapur are in Asia Minor or elsewhere in the world but they are certainly in the Aryavart, which is India.

# India – The Aryavart According to King Manu

People in other countries and continents west of India addressed the residents of Aryavart (Bharatvarsh, now India) as the people 'across the Sindhu River (Indus River)' or just the Sindhu. The invaders addressed the residents of Aryavart as the Sindhus. But the language deficiency changed the sound of the letter 's' into the letter 'h' and the word Sindhu turned into Hindu. The term Sindhu-sthan (place of Sindhus) turned into Hindu-sthan. It finally became Hindustan. The distortion of a distortion having no limits, Hindustan changed into Indis and India. A distorted version of the Sanskrit term *sthaan* for 'place' changed into *taan* or *tan* which is found as the suffix in the names of many countries in the north-west of India: Baluchistan, Tajikistan, Afghanistan, Kyrgyzstan, Uzbekistan, Kazakhstan and so on. This also shows that the Sanskrit language at one time had reached regions far from India.

Just as the debate on AIT continues the debate between some linguists on the origin of the word "Hindu" still continues. Some suggested that the deficiency in pronouncing the letter 's' was brought into India by the invading Aryans which they improved upon later. The Aryans had to be somewhere on the Earth then why is it so difficult to accept that they could be living right there in India. The fact is that from the very beginning, starting from the Vedas, the Sanskrit language has had a large number of consonants and vowels giving rise to unique sounds including the sound of 's'. The single letter symbols to represent differing sounds of the same consonant are part of the Sanskrit alphabet set. As a sample, let us take the Sanskrit consonant **ल** which is equivalent to the 12th consonant 'L' in English. Without presenting here all the variations of **ल**, the five variations of the sound of **ल** in Sanskrit are: लं, लँ, ल्, **ऌ, ळ**. The symbols added to **ल** are respectively: a dot on top, crescent moon with a dot on top, a slanted dash underneath, sideways u under it and a reformed **ल** into **ळ**. They all change the sound of the basic consonant **ल**. The exact sounds of these five variations of **ल** are difficult to express with English alphabets, however, the

closest sounds corresponding to these five variations respectively are: *lum, lumg,* half pronounced *la*, *lri* and *lrd*. The Sanskrit language, being highly developed and sophisticated, is not limited in sounds that humans produce. Therefore, the confusion between the consonant *s* and *h* could never arise out of Sanskrit and is rooted in some under-developed languages of the regions beyond the Aryavart.

The Vedas themselves provide fully developed sounds and terminology of their language, Sanskrit. For the sounds of *h* and *s* appearing side by side one has to look at the first RigVeda mantra. The third word *purohitam* utilizes the consonant h, pronounced as in the word 'him' and right after that its fourth word *yajyasya* utilizes the consonant s, pronounced as in the word 'say'. Both sounds thus pronounced separately in the very first mantra of the Aryans' first book would enable the Aryans to correctly pronounce the consonants *h* and *s*. The fact remains that Hindustan is not the name of India it is Bharatvarsh which used to be Aryavart. The AIT's propagation through the British education system in India has created a deep division between north and south Indians, the latter believing that northerners were the invader Aryans and the southerners were the suppressed Dravidians. The old name of India, Aryavart, was discouraged and it is not in usage now. Bharatvarsh as the official name of India was however accepted by most Indians.

The first known name for India in the Vedic Literature is what Svaayambhuva Manu stated in his Manusmriti, the Brahmavart, meaning the place of Brahma the first known human to have preached all four Vedas to the society. The alternate meaning of the word Brahmavart is 'the place of learned people', the Brahamanas. Five *shlokas* from the ancient book of Manusmriti that relate to this topic are presented below. Manu has given a geographic definition of what now is Bharatvarsh. He has done this in three steps - starting with Brahmavart, a small region of the greater Bharatvarsh and then defining its Maddhya Desh (Central Region) and finally defining the whole nation that he addressed as Aryavart. In addition to the geographic description of Aryavart, Manu has also briefly presented its characteristics in terms of sociology and ecology.

Once Manu's definition of Aryavart is in place the reader will understand that this Aryavart has been inhabited by the Aryans from the very beginning of the Aryan Civilization, they are its indigenous people and have never been the invaders from Asia Minor or any place else.

Manusmriti's chapter and *shloka*-numbering in this book are according to the 1966 publication entitled "Vishuddha Manusmriti" with accurate Hindi translation of *shlokas* and enlightening interpretive commentary by Professor Surendra Kumar. In this publication of Manusmriti, both subjects, the Srishti-Utpatti (Birth of the Universe) and Dharma (duties) are included in the first Chapter unlike in other publications where the two topics are separated in two successive chapters.

The three *shlokas* on the geographic description of Aryavart are presented first. King Manu's first step in defining the nation that he ruled, is in the following *shloka*,

सरस्वतीदृषद्वत्योर्देवनद्योर्यदंतरम् ।
तं देवनिर्मितं देशं ब्रह्मावर्तं प्रचक्षते ॥

(Manusmriti, 1/136)

**Transliteration**: "*Sarasvati-drishdvatyo-r-devanadyo-r-yadntaram. Tam devnirmitam desham brahmaavartam prachakshate*."

**Translation:**

*The region between Sarasvati and Drishdvati, the rivers in union with virtuous sages and brilliant scholars, inhabited by devas the virtuous people with noble character and brilliant qualities, is said to be the region of Brahmavart*." (Manusmriti, 1/136).

It is well known in Sanskrit Literature that the River Sarasvati with its magnificent roar did exist and it is also stated that it disappeared with time, sometime in the antiquity of the Vedic Civilization. In the Sanskrit Literature the River Sarasvati is revered and is known for its shores being the abode of *rishis*, *munis*, sages and ascetics where they created brilliant pieces of literary work such as the Brahmanas, Upanishads, Smritis and Sutras that form the backbone of the Vedic religion and philosophy and continue to provide an unwavering foundation for present day Hinduism. Since a lot of knowledge has flowed from the shores of Sarasvati like the flow of its water, the ancient *rishis* named it as the River Sarasvati. Considerable discussion on the term '*sarasvati*' is in Chapter 4. The term

*sarasvati* appearing in differing connotations in the ancient Vedic Literature relates to different subjects. However, in the context of the Manusmriti *shloka* given above, Sarasvati is one of the two rivers serving as a boundary of the Brahmavart region.

The River Sarasvati of Manu's *shloka* is now extinct. Since this is the river with a sempiternal relationship with Vedic Literature and the Vedic Civilization, people continued to wonder about this legendary river and wondered if it existed in reality. The Vedic literature has presented a picture so vivid that people continued with the ancient belief that it had its origin in the Himalayas and fell into the Paschim Samudra (Western Sea) which is now known as the Arabian Sea.

The names of both rivers in Manu's *shloka*, Sarasvati and Drishdvati, are not found among the existing rivers on the current map of India. Based on Vedic Literature, several authors have depicted the presumed trajectories of these rivers on the map of India. Professor Surendra Kumar in the Hindi interpretive translation of Manusmriti has presented a geographic map of India depicting Sarasvati and Drishdvati rivers. In the present context a sketch of Northern India is shown in Figure 3.3 with the main rivers, mountains and places labeled. The rivers Sarasvati and Drishdvati are shown in magenta-dashed lines. The dashed line represents a river that is currently not on the geographic map of India.

Manu defines the region between the two rivers as Brahmavart shown in orange. But if the two main rivers named by Manu are not on the present Indian map, how can we ascertain that Brahmavart region ever existed in India? That the Brahmavart was part of a bigger region within India becomes obvious from Manu's *shloka* that followed. Not including all the *shlokas* given in between, the relevant *shloka* defining the boundaries of the Maddhya Desh (the Central Country) is,

हिमवद्विन्ध्ययोर्मध्यं यत्प्राग्विनशनादपि ।
प्रत्यगेव प्रयागाच्च मध्यदेश: प्रकीर्तित: ॥

(Manusmriti,1/140)

**Transliteration**:

"*Himvdvindhyayor-madhyam yatpraagvinshanaadpi |Pratyagev prayaagaachch madhyadeshah prakeertitah*."

**Translation:**

> *"The region between the Himalaya* (in the north) *and the Vindhya* (in the south), *and also from east of Vinshan Region* (devastated region) *to the west of Prayag is called the 'Madhya Desh'* (central region)". (Manusmriti,1/140).

Manu in the earlier shloka used the rivers to define the geographic region of Brahmavart. In this shloka he defines a larger region Maddhya Desh using the mountains and identifiable geographic regions. The north-south span of the Maddhya Desh (Central Region) is defined by Himalaya in the north and Vindhya Mountain range, just south of river Narmada (Figure 3.3). Himalaya (meaning: the abode of ice) of Manusmriti is still Himalaya and Vindhya Mountain range of Manusmriti is still Vindhya with the added adjective of '*achal*', meaning 'stable'. Its common name now is Vindhyachal. The Prayag in the east is still Prayag. Prayag, the eastern point of Manu's Maddhya Desh, is the city of Prayag in the present Indian state of Uttar Pradesh, situated at the confluence of the rivers Ganga and Yamuna shown by the blue lines. This defining coordinate for the ancient central region of the Bharatvarsh has been a holy city and the oldest city in India (probably oldest in the world). The Maddhya Desh is present Maddhya Pradesh, a state in the Central India, though much smaller than the Maddhya Desh of Manusmriti. This area is shown in the map in light pink with its southern boundary along the Vindyachal Mountains. With so much continuity in the nation-defining terminology in Manusmriti the rivers Sarasvati and Drishdvati that bounded the Brahmavart region must also have been a reality during King Manu's time. All these land-marks do exist with their original names in the present Indian geography, except for the Vinshan Region to the west of Maddhya Desh.

A remarkable geographic observation in Manu's shloka is the label of 'Vinshan' for a region which is the western region of the Maddhya Desh. On one hand Manu states that it is the region of the great river Sarasvati and on the other hand it is also labeled as the Vinshan region. The meaning of the word *vinshan* is the region that 'perished' or was 'destroyed'. Geographically the Great Thar Desert in the state of Rajasthan should represent the Vinshan Region of Manusmriti. The southern part of it extends into the State of Gujarat with its name as Rann of Kutch. The course of Sarasvati shown in the map of Figure 3.3 by a dash-line is based

on other ancient references, which are now confirmed through scientific rediscovery of the extinct River Sarasvati. The Vinshan Region on the map is arbitrarily marked by this author along the assumed course of Sarasvati. Further discussion on the Vinshan Region of Manusmriti is taken up later in the following.

Notice that Manu started with a narrow region of Brahmavart, expanding to the central region of Maddhya Desh. Manu's third step extends to encompass an even bigger geographic region to define 'Aryavart'. Manu's next *shloka* (1/141) therefore is the nation defining statement,

आसमुद्रात्तु वै पूर्वादासमुद्रात्तु पश्चिमात् ।
तयोरेवांतरं गिर्योरार्यावर्तं विदुर्बुधा: ॥

(Manusmriti, 1/141)

**Transliteration**:

"*Aasamudraattu vai poorvaadaasmudraattu pshchimaa*t ।*Tayorevaantaram giryoraaryaavartam vidurbudhaah* ॥"

**Translation**:

"*One that exists from Poorva-samudra* (East-Ocean) *to the Paschim-samudra* (West-Ocean) *and bound by the mountains is proclaimed by the learned as the Aryavart* (the place of Aryans)." (Manusmriti, 1/141)**.**

With the two seas on either-side and the Himalaya in the north (in previous shloka) Manu does not leave any doubt as to which country is the Aryavart. Also, it is not that he is naming this region as Aryavart; he is clearly crediting the 'learned' for proclaiming thus defined land to be Aryavart. Implicit here is that as indicated in his shloka, this land was known as Aryavart before Manu. If one defines the central region of a country it is obvious that the country extends on either side of the central region. Therefore the Aryavart extends beyond Sarasvati in the west probably up to river Sindhu (Indus) and beyond Prayag in the east up to Burma, ancient name being Brahma Pradesh, which now is Myanmar. Similarly the Aryavart must extend beyond the southern boundary of the Maddhya Desh at Vindyachal Mountain range. This also makes it clear that Manu had a full grasp of the geography of Aryavart. Therefore it can safely be concluded that according to Aryan literature, the Manusmriti being the

present context, Aryavart is the most ancient name of the country where Aryans lived.

The suffix 'vart' to the words Brahma and Arya forming respectively Brahmavart and Aryavart means the 'place of' or 'inhabited by'. This should suffice to close the debate on where the Aryans lived. Brahma in the Vedic Literature is known for preaching the four Vedas to the Aryans in the beginning of the Vedic Civilization. Therefore the two names of the country were proclaimed in Manusmriti, relating respectively to the Vedas and the inhabitants. The Veda has adorned with beautiful adjectives the term used for a person following the Veda. The multi-meaning term '*arya*' stands for '*ishvar putra*' meaning 'God's progeny'. Virtue-based derived meanings of the term arya lead to different closely related meanings; most common being 'person with noble character and qualities'. The word arya has no race connotation in its meaning. Manu in his Manusmriti has also described the nature of the people living outside the boundaries of Aryavart. Such a nation-defining description for a country is perhaps unique in ancient history and literature. To suggest that the Aryans lived elsewhere before they invaded Aryavart (India) is a theory based on ignorance.

The rivers Sarasvati and Drishdvati, shown by dash-lines on the map of India (Figure 3.3), are extinct and exist in the Vedic Literature and legends only. Swami Dayanand Sarasvati while writing Satyarth Prakash in the late eighteen-eighties interpreted Sarasvati and Drishdvati to be the rivers Sindhu (Indus) and Brahmputra. According to him Aryavart extend from the centre of Himalaya in the north to Rameshvaram in the south.

## Prayag, a most ancient City

The city of Prayag mentioned in Manusmriti got its name from what it stood for. The meaning of the word '*prayag*' is - "the place where the *'yagjya'* is performed with perfection" (*yagjya* is the sacred fire-oblation). The people performing *yagjya* are called the *yagjyiya* people for they have the welfare of others in their thoughts and actions and are considered to be devoted to the Almighty Brahmn and are therefore called brahmanas. Prayag has been a center of Vedic culture from the time it came into existence and continues to be important till today. Historically, the city of Prayag has a strong relationship with Maharishi Bharadwaj, an often-

mentioned figure in Vedic Literature. His ashram was in Prayag. He was contemporary to King Ram of Ayodhya and Rishi Valmiki who wrote Ram's biography which is famously known as Ramayana.

Valmiki Ramayan has devoted 22 *shlokas* in the 42nd *sarg* (section) of Ayodhya-Kandam (chapter) on the historical concourse of Prince Ram, his wife Princess Sita and his younger brother Prince Lakshman with Rishi Bharadwaj at his Prayag ashram. The Prayag ashram is a significant stop in the journey of the trio after they left the Kingdom of Ayodhya for life in the forest. They spent one night with Rishi Bharadwaj at his ashram. Ramayana *shlokas* on Rishi Bharadwaj welcoming these guests to his ashram indicate that this was not the first meeting between Ram and Rishi Bharadwaj.

They had considerable intellectual exchange before retiring for the night. Next morning Ram took permission of Rishi Bharadwaj before leaving the ashram to continue forest-living for 14 years, to fulfill the commitment made by the obedient son Ram to his father, Emperor Dashrath. This unfortunate situation arose because Dashrath was forced to keep a promise that he had made to his first queen. The queen demanded that her son Bharat, who was younger to Ram, be enthroned and Ram be exiled to the forest for 14 years. Rishi Bharadwaj, reciting Veda mantras and showering his blessings on Ram, Sita and Lakshman, saw them off.

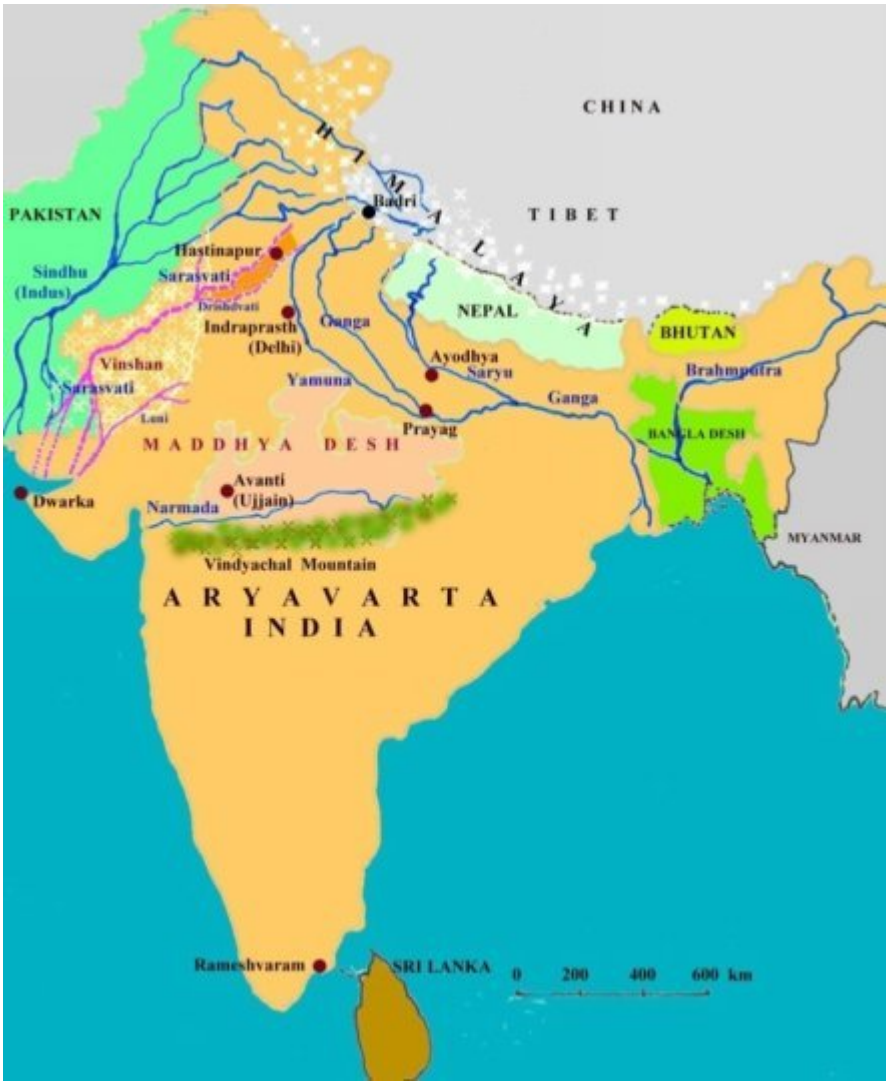



**Figure 3.3:** Map of Aryavart (India) with defining landmarks mentioned by Manu in his Manusmriti.

Ram, Sita and Lakshman crossed the River Yamuna at Prayag to visit the great poet Rishi Valmiki whose ashram was at Chitrakoot Mountain. It is this ashram where Valmiki was inspired to write Ram's biography (Ramayana) in shloka poetry in anushtup-chhand meter of 32 syllables. Prayag and Chitrakoot, having such incredible historical significance, continue to be highly revered pilgrim places for Hindus. Historical chronology has it that Ram being in Manu's dynasty, many generations after Manu, his contemporary sages Bharadwaj and Valmiki are not mentioned in Manusmriti. On the other hand in Valmiki Ramayana there are numerous references to Manu and his dharma principles that he laid down

in Manusmriti. Rishi Valmiki, citing Manu at places in the Ramayana has even reproduced Manusmriti shlokas with little variation.

Manusmriti's Prayag continues to be a real chapter in India's ancient and modern history. However, the Manusmriti's River Sarasvati is absent from India's present geographic landscape. This led some early Indologists to hypothesize, purely on speculative grounds, that the statements in Manusmriti were fictitious and that the book of Manusmriti is not necessarily authored by Manu and that it was put in poetic form sometime after 300-400 BCE. The well-known Indian history of this period discussed below contradicts these Indologists. This was the period when Buddhism peaked in India while Manusmriti's laws were already ingrained in the Aryan society.

# River Sarasvati Corollary

To get India out of the claws of contemporary distortions in its history one has to make an additional effort to show that the nation-defining geographic features in Manu's *shlokas* in Manusmriti are real. The presence of the Himalaya Mountain range in the north, the Vindyachal Mountain range in the central region, the East Sea and the West Sea surrounding its land mass is indisputably accurate. The reference of the historical city of Prayag in Manusmriti was also substantiated by references in post-Manusmriti Valmiki Ramayana describing historical events and persons. The validity of the reference of the mighty River Sarasvati in Manusmriti is an added proof of the ancientness of this landmass. To shed light on this historical aspect of Aryavart, to advance the discussion further, let us begin with a corollary formulated by this author on River Sarasvati.

"*Manusmriti's River Sarasvati of nation-defining significance presently does not exist on the Indian sub-continent. If it is proven that the River Sarasvati was a reality at one point in the Aryan history with its existence in the region mentioned in Manusmriti, it will be self-proven that Manu, the author of Manusmriti, was a real historical person*".

This corollary is proven in the following.

Presently, a seasonal river called Ghaggar flows in the dry riverbed where the ancient course of Sarasvati is assumed to have existed. Ghaggar flows through the state of Haryana, continues in the desert of the western state of Rajasthan with its name changed to Hakra and it continues into Sindh region of Pakistan as Nara. It is Ghaggar's dry bed in Rajasthan where in 1893 CE an English engineer named C. F. Oldham (Ref: "Recent Research on the Sarasvati River", www.stephen-knapp.com) was riding his horse when he observed that this seasonal river had little water when flowed, yet its bed was 3 km wide. He thought that it could be the course of a bigger and wider river at some point in time and that it just could be the River Sarasvati that continued to exist in Hindu mythology! What Oldham envisaged was Sarasvati, but its discovery was to wait for a century, when

India after gaining independence from the British, progressed in leaps-and-bounds in its scientific endeavours. Indian government initiated the "Sarasvati Project" to investigate the 'myth' of Sarasvati. The extraordinary feature of the "Sarasvati Project" was that the investigating teams were formed from multidisciplinary science disciplines with state-of-the-art equipment at their disposal. The researchers of India, many of whom are world-renowned scientists, discovered the extinct legendary River Sarasvati. The evidence is in a large number of science publications.

## The Scientific Proof of Extinct Legendary River Sarasvati

The unraveling of the mystery of the invisible River Sarasvati started in the 1980s when simultaneously various scientific methodologies were applied. A coordinated team-work of Indian national scientists of international repute, utilizing most modern remote sensing systems and ground-truthing data revealed that the said enormous River Sarasvati existed in the distant past, in the same region. This coordinated team-work under the national project named "Sarasvati Project" included remote sensing scientists, geologists, geographers, archaeologists and climatologists. The long-term study involved satellite imagery from earth-observing satellites; LANDSAT of NASA (National Aeronautics and Space Administration, USA), Remote Sensing Satellites IRS-1C and IRS-P3 of ISRO (Indian Space Research Organization) and European Remote Sensing Satellites ERS-1 and ERS-2 of ESA (European Space Agency).

In addition to ground and satellite data a pool of palaeoseismic and palaeoclimatic records enabled the scientists to reconstruct the drainage evolution in north-western India. The term "palaeoseismic records" means the geological evidence of earthquakes from the prehistoric times and likewise the term palaeoclimatic records means the climatic records available from geological information from ancient times. On one front the LANDSAT imagery revealed the river valleys and their courses under the

Thar Desert and the Rann of Kutch and on the other front the drilling and hydrological studies of the palaeo channels were used for the dating technique. It was discovered that the magnificent River Sarasvati of ancient Vedic Literature flowed where it was said to have flowed and that it had three major tributaries, Shatadru (Sutlej) originating from the Mount Kailash, Drishdvati and Yamuna from Shivalik Hills. These rivers formed the mighty Sarasvati and charted the course along which the present seasonal river Ghaggar flows. The satellite images show that at certain places the River Sarasvati was up to 8 km wide.

The Sarasvati Project was broadened to include research disciplines of other national research agencies of India, such as the NRSA (National Remote Sensing Agency), BARC (Bhabha Atomic Research Centre), ISRO, GSI (Geological Survey of India) and CWC (Central Water Commission). Based on the information from the published research, some of the important discoveries that relate to the River Sarasvati included the observation of the vegetation cover thriving on the loamy residual soil along the course of Ghaggar through the states of Punjab, Haryana and Rajasthan. In 1995, discovered in the data of IRS-1C, combined with RADAR imagery from ERS, were huge palaeo-channels under the Thar Desert of Rajasthan that were independent of any connection to Indus River. BARC found ground-water in the Rajasthan desert 50 to 60 meters underground with the water depth ranging from 15 meters up to 40 meter. It is estimated that such a huge quantity of ground-water is enough to sustain agriculture even during severe summer conditions.

After India's Pokhran underground nuclear test in 1998, BARC tested the underground water for radioactive tritium. In the process, they found at these Rajasthan desert sites the potable (drinkable) water of Himalayan glacier origin that was some 8,000 to 14,000 years old. They also found that this water was presently being recharged through aquifers from some locations in the north**.** The geological term aquifer represents a porous deposit of rock, like sandstone, that contains underground water available in wells. The presence of an 'Underground River' along the expected path of River Sarasvati was confirmed by data-streams from different research disciplines, leading to the conclusion that ISRO's findings of the River Sarasvati were based on scientific truth. The decrease of the levels of radio-active Carbon-14 along the downstream of the underground-river also establishes hydraulic continuity of the buried Sarasvati. Scientific studies

suggest that the river dried up around 2000 BCE coinciding with the extinction of the Harappan Civilization.

## The Cause for Sarasvati's Disappearance

The geological evidence suggests that the cause for Sarasvati's disappearance is the tectonic activity (earthquake) raising the plate near the Himalayan foothills, cutting the river off and diverting its tributaries; Yamuna to the east meeting Ganga and Satlaj to the west meeting Indus. The geological ground-faults near its origin and along its course are the geological evidence of the tectonic activity that took place in several phases. A large number of scientific papers on Sarasvati's existence and disappearance are the outcome of this multifaceted scientific study involving satellite observations of the region and ground measurements by the prominent scientists: Yashpal, B. Sahai, R. K. Sood and D. P. Agrawal in "Proceedings of Indian Academy of Sciences, Earth and Planetary Science", (Vol. 89, pages 317-331, 1980); K. S. Vaidiya in "Resonance", May, 1996; just to cite a few. They have deciphered the mystery of River Sarasvati and concluded that there were geological reasons and events for the disappearance of Sarasvati and Drishdvati, the nation-defining rivers of Manusmriti.

The well-known geological fact is that the formation of the Himalayas is the result of the plate-tectonic activity wherein the Indian continental plate is moving north pushing against the Tibetan plate. Recent geological studies have shown that the whole Shiwalik region from one end of the Himalaya to the other continues to be geologically active. The studies have discovered that owing to severe tectonic activity, the Shiwalik region was destroyed about 1.7 million years ago changing the course of rivers that were there earlier. This region has continued to be unstable, frequently changing the geology of the Himalayan foothills resulting in the change of river trajectories.

The geologists have found that due to the geological tectonic activity leading to earthquakes, large land areas have shifted, been destroyed and tilted, changing the course of the rivers several times in north-eastern India. It was one such or several such tectonic events in relatively recent geological times that diverted River Yamuna from the River Sarasvati and cut off Shatadru (Sutlej) near the town of Roper giving it a sharp turn and

sending it west to the River Sindhu. The water supply to Drishdvati and Sarasvati was thus cut off.

Climatological change descended on the 'Vinshan Region' of Manusmriti which is now known as the Thar Desert of Rajasthan which according to new geological findings once was a lush region. When the region started to turn into an extended desert it engulfed whatever was left of Sarasvati, along with the settlements at its banks. After many scientific conferences and journal publications it has been established that the lost River Sarasvati is a scientific fact with a well-established course of the river. Mighty Sarasvati's run from its origin to the sea is estimated to be about 1600 km. Sarasvati's existence in India's glorious past is a historic fact.

## Reconstructed Course of Sarasvati

From these new data gathered under the Sarasvati Project the prominent geologists have reconstructed the course of the extinct River Sarasvati. The same pool of data have also enabled reconstruction of the extinct and changed courses of other rivers in the same region. Based on these measurements and the follow-on geological correlations, a picture emerged that depicted the course of Sarasvati and its tributaries (see K. S. Vaidiya in the May, 1996 issue of the science publication, "Resonance"). This is shown in Figure 3.4.

In this figure a dotted line shows the ancient course of the river and a solid line represents the present course of the same river. Over several sections of the river-trajectories the ancient and present courses remained coincident. It is interesting to note that the River Sutlej with its Vedic name Shatadru, which now joins River Sindhu, used to turn near the town of Ropur to join Sarasvati. This grouping of the extinct ancient rivers presents the region between Sarasvati and Drishdvati that Manu addressed as the Brahmavart region, which stretched east-west and is a bit larger than as shown in the earlier Figure 3.3

**Figure 3.4:** North-Western river system, past (dashed line) and present (continuous line) (Ref: K. S. Vaidiya, May, 1996, Resonance, pages: 19-28).

The scientists have mapped about five additional tributaries of the extinct Sarasvati, including Yamuna (Palaeo-Yamuna) and the extinct River Drishdvati. The scientific data have thus yielded the final geographic picture with curves and twists in the course of River Sarasvati and its tributaries. The River Sarasvati with its source in the Shiwalik Hills at the foothills of the Himalayas in the present state of Himachal Pradesh, flowed through the areas of the states of Punjab, Haryana, Rajasthan and in the area called Kutch in Gujarat, immersing itself in the Paschim Sagar (Arabian Sea). Sarasvati flowed more or less parallel to the River Indus, its Vedic name being Sindhu.

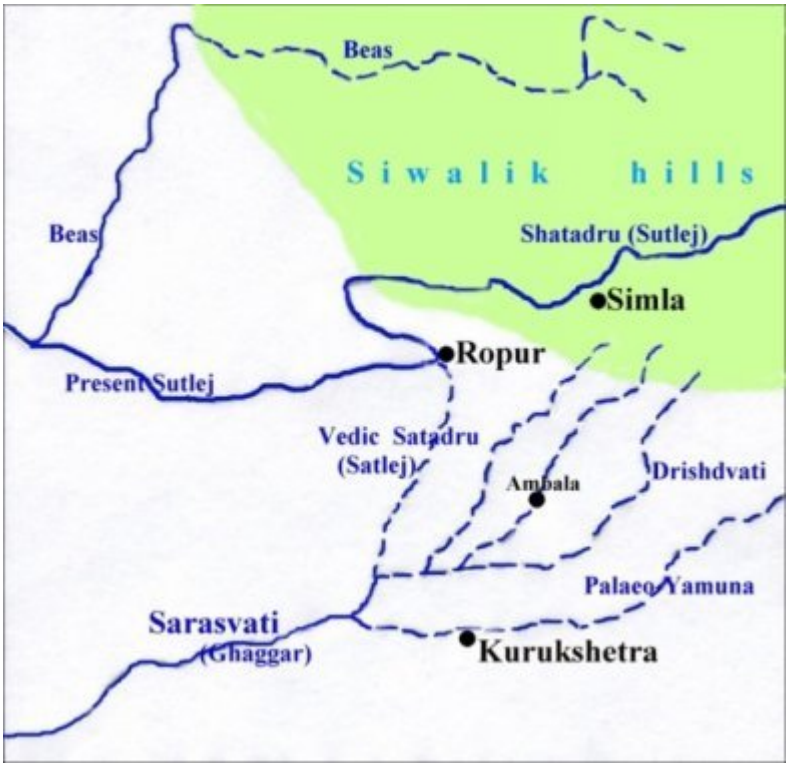



**Figure 3.5:** The Sarasvati river system based on Vaidiya, S. K. 1996,and Yashpal et al. (1980).

In defining the main course of Sarasvati there is no difference of opinion among the scientists of different disciplines that joined hands on the Sarasvati Project. There is no difference of opinion among them on the courses of two other rivers, Paleo-Yamuna and Drishdvati. The difference of opinion if any is on the position of Paleo-Yamuna and Drishdvati. The other group prefers to interchange the positions of these rivers from what is shown in Figure 3.4 to that shown in Figure 3.5.

Yashpal, B. Sahai, R. K. Sood and D. P. Agrawal (Proc. Ind. Acad. Sci., Earth Planet. Sci, Vol. 89, pages 317-331, 1980) with their extensive investigation from multi-facetted data have emphasized the grouping of tributaries as shown expanded in Figure 3.5.

For simplification of the diagram all details of other extinct rivers that have been discovered are not shown. The group of rivers that supplied water to Sarasvati originated from Shiwalik Hills shown in light green. The River Sutlej undisputedly was a big tributary of Sarasvati and flowed south from around Ropur along the dotted line to join Sarasvati before a

cataclysmic event changed its course. Yamuna being a big river itself would add to Sarasvati's magnificence.

The discovery of the legendary rivers, Sarasvati and Drishdvati, based on the scientific methods and multi-disciplinary data tells us that King Manu did not imagine these rivers. These rivers were a reality during Manu's time. This would also lead us to the facts stated by Manu, that the River Sarasvati of his Manusmriti was nowhere else but in Manu's Aryavart, the place of Aryans, its indigenous people, who followed the Vedas and created enormous Vedic Literature on the banks of River Sarasvati.

The ground water research and the research in other disciplines have shown that the River Sarasvati started to diminish well before the period of Mahabharata 3140 BCE and it was around 2000 BCE that it practically disappeared. The above discussion on the existence of the River Sarasvati on the Indian sub-continent, based on the scientific proof, validates the River Sarasvati Corollary, formulated a few sub-headings earlier.

The scientific discovery of multiple tributaries feeding the River Sarasvati also validates the *rudhi* meaning for concrete objects of the term *sarasvati*, the etymology of which yields - *one with many tributaries*. An automatic conclusion from the above discussion is that any Vedic Literature that makes a mention of River Sarasvati is at least 4000 years old (2000 BCE). This takes us well before the age for the Vedas, Manusmriti and Ramayana assigned by some Indologists and Western historians.

The River Sarasvati is also mentioned in the book of Mahabharata. Since more convincing proof of the Mahabharata War ending in 3140 BCE with the coronation of King Yudhishthir is to come in the following, a reference to River Sarasvati in Mahabharata is as reliable as the scientific deductions based on the recent scientific data published by reputed scientists that the River Sarasvati existed till about a thousand years after Mahabharata. This is the same as saying that Sarasvati's waves ceased somewhere around 2,000 BCE.

## Vedic Civilization at the Shores of River Sarasvati

It was the *rudhi* meaning of the term *sarasvati* that represented the mighty River Sarasvati. The River Sarasvati was named most appropriately

because it represented an embodiment of 'dynamic action of perpetual movement of water with many tributaries'. The *yaugik* meaning of the term *sarasvati* that it is 'specific human intellect' (discussed in Chapter 4) was also fulfilled because its shores served as the abode of *rishis* and *munis* who developed knowledge at its banks, knowledge that is perpetuated through the Vedas and the Shastras of the Sanskrit Literature. Where there is knowledge, wisdom follows, which in turn leads to prosperity. There are all indications that the Ayravart at one time was a prosperous nation (see Valmiki Ramayana's Ayodhya Kaandam). Those references on prosperity in Aryavart are from the ancient references, however, the recent references related to archaeological finds along the shores of rediscovered extinct River Sarasvati exhibit a thread of continuity in Aryavart's prosperity.

Simultaneous with various scientific methodologies that were utilized in discovering the legendary River Sarasvati, the Indian archaeology made big strides in the past five decades. A large number of publications on Sarasvati re-discovery and archaeological sites on its shores are made available by Dr. S. Kalyanaraman who has set up a website, http:www.hindunet.org/saraswati, on "River Sarasvati and Civilization" enriched with 30,000 files on it. As he put in the summary of the colloquium held on January 5 and 6, 2003 (some details furnished below) he stated –

> "*The river (Sarasvati) is not a myth but is ground-truth and had drained in North-west Bharat over a distance of 1,600 kms from Manasarovar, Mt. Kailash to Gujarat (Somnath, Prabhas Patan)*."

The rediscovered course of Sarasvati is the present course of the dry river Ghaggar. Out of over 2,600 archaeological sites discovered in the past five to six decades by the archaeologists, the sites that are termed as the Indus Valley Civilization or Harappan Civilization first discovered in 1922, about 2,000 of them are found on the banks of the River Sarasvati and are 3,000 BCE old. Several of these, too many to name here, are larger than Harappa and Mohenjo-Daro. Over a dozen other culturally vibrant sites on the banks of the River Sarasvati begin from Ropur in the north through Kaalibangan in Rajasthan reaching Dwarka with marine-riverine culture. A remarkable discovery among these sites is the prehistoric town of Kaalibangan in Rajasthan State that has furnished a treasure trove of information. It has exhibited that among the citizens of this town were

priests, farmers, merchants and highly advanced artisans and craftsman. The discovered seals with inscriptions indicate that these people were educated. There were all signs of River Sarasvati once flowing in the same bed where now flows the seasonal river Ghaggar. Recent research articles indicate that the total number of discovered sites have gone up from 2,600 in 2003 CE to about 16,000 at the present time. It becomes obvious that the prosperity of these ancient towns was supported directly and indirectly by the 'vast and awesome' River Sarasvati. None of the sites along the River Sarasvati indicate signs of war between the locals and any invaders because the Aryans did not come from anywhere else. They were always here.

The above discussion on the extinct River Sarasvati based on its geographic information in the historic Manusmriti and its subsequent rediscovery based on multi-faceted modern scientific studies under the national Sarasvati Project of the Government of India should put an end to AIT and other groundless hypotheses on Vedas and Vedic Literature by some Western Indologists and their Indian followers. References of River Sarasvati validate our Timeline-A in Figure 3.1 thus establishing the antiquity of references on Vedic cosmology principles which form the basis for this book. Also established here is the fact that Manusmriti itself is older than Mahabharata and Ramayana. When one walks the path of history from Manu towards Mahabharata one finds references of River Sarasvati in post-Veda and post-Manusmriti Sanskrit Literature. The River Sarasvati is crowned with many adjectives such as 'The Great River Sarasvati, 'most momentous', 'with ceaseless flow', 'a river with thunderous noise', 'vast and awesome', 'most holy River Sarasvati' and so on.

## Why is Sarasvati important for this chapter?

The first reason is to establish the historicity of references, Manusmriti, Ramayan and Mahabharata. As mentioned above, Sarasvati for Manu was a nation-defining great river which after his time disappeared and which continued only in legends in post-Mahabharata Sanskrit Literature until it was rediscovered in recent times through scientific measurements and methods. The second reason is Sarasvati's association with Rishi Vedvyas who carried out astronomical observations from its shore, which he has mentioned in the text of Mahabharata. These astronomical observations have been examined by modern astronomers using modern-day

computation of accurate equations in astronomy that take us back to 3000 BCE right to the time of the astronomer, Rishi Vedvyas.

Therefore, if the River Sarasvati existed even after the book on Mahabharata was written the Vedic references as old as and older than Manusmriti, used in this book, are older than 3000 BCE. This certainly frees us from the clutches of AIT.

## Sarasvati and Astronomy in Mahabharata

The book of Mahabharata, right up to its last chapters, has numerous references of the River Sarasvati. The River Sarasvati's relation to the region of Kurukshetra, the capital city of Hastinapur and to Rishi Vedvyas is quite vividly depicted in the book of Mahabharata. An example from Mahabharata's Mausal-parv (Mausal-division), presented in the following is quite revealing.

Krishn being a just and powerful king fought several wars for just causes. His participation in such wars was on request from kings vulnerable in military to face attack from greedy and unjust kings. His participation was with the aim to establish law and order and *dharma*. After a while this great yogi chose to renounce war and violence. Along with his brother Balram, he had moved his capital, before Mahabharata War began, from Mathura to Dwarka at the sea-shore in the Gujarat Region. Krishn was now addressed with the new adjective of 'Ran-Chhod', meaning the one who renounced participation in wars. When Mahabharata War ended just before 3140 BCE, Yudhishthir was seated on the throne of Hastinapur and Krishn was already ruling peacefully from Dwarka. Krishn ruled peacefully from Dwarka for four decades.

Human nature being the way it is, strifes developed in the region of Dwarka. Towards the onset of Kali-Yuga epoch in 3102 BCE the region went into turmoil and civil war broke out between different groups and clans. This resulted in chaos and confusion with large numbers of people displaced from their farms and homes. Upon learning of the situation, the Emperor Yudhishthir of Hastinapur (Delhi) deputed his brother Prince Arjun to go to that region and help his best friend and charioteer in the Mahabharata War, none other than Krishn. Prince Arjun intervened and helped to settle the strife-afflicted homeless people of the different clans. After that Arjun returned to the capital of Hastinapur with a stop at Rishi

Vedvyas's ashram. A brief relevant description of the events according to the Mausal-parv (4/53-55) of Mahabharata goes thus:

> "*Arjun settled Saatyaki's son Yauyudhaani with all elderly and children, in the region at* ***Sarasvati****'s shore and made him the Governor. Then Arjun asked Vajra to be the ruler of Indraprasth. After settling the devastated people in anguish, Arjun returned. He reached* ***Rishi Dvaipayan Baadrayan Vedvyas****'s ashram with heavy heart and tears in his eyes. With utmost respect to the rishi, pronouncing his name he bowed at rishi's feet. Seated in great peace the rishi born to the mother Satyavati said to Arjun – 'Son, I welcome you, come and sit here…. and tell me why you are looking depressed and wearisome?' Arjun said – 'the one with lotus eyes, the one with most attractive dark complexion, the great Krishn has just died and also dead is his brother Balram… and I feel as if the ocean has dried up, the mountains are shaking and the sky is torn apart…'."*.

In addition to the human element in the narration there is also a part of the ancient history in it. The most relevant aspects of this description (abridged here) are the references to the River Sarasvati and to the Rishi Vedvyas, the author of the book of Mahabharata and the Vedanta Sutra. It shows the reality of the River Sarasvati and its usefulness for people to settle near it and prosper. It also shows that Rishi Vedvyas's ashram at the bank of Sarasvati and the city of Indraprasth at the shore of Yamuna River were places not too distant from each other. There are all indications that Sarasvati flowed just west of Kurukshetra, the battlefield of Mahabharata War (marked on Figure 3.5) and that River Sarasvati has direct relevance with the writer of the book of Mahabharata and the Vedanta Sutra, Rishi Vedvyas. This great *rishi*, a possible descendent from the region of the Badri-forest, with his full name being Badaraayana Krishn Dvaipaayana Vedvyas, was not only a philosopher who gave us the Vedanta Sutra, but he was also a great astronomer engaged in practical astronomy, observing planets and constellations from his ashram at Kurukshetra at the bank of River Sarasvati, about 300 km south from Badri (marked on Figure 3.3) and 160 km north from Indraprasth (modern Delhi).

To establish the historicity of the Kurukshetra War (Mahabharata War) a colloquium was organized by "Akhila Bharatiya Itihasa Sankalana Yojana" (All-India History Compilation Plan) under the auspices of the Mythic Society, Bangalore, India and Sir Babasaheb Umakant Keshav Apte Smarak Samithi Trust, on January 5 and 6, 2003. This conference was unique in that, in addition to historians and archaeologists, it was well attended by the scholars from across the world in science disciplines such as astronomy, geology and physics. The papers presented at this conference were related to Sarasvati references in the book of Mahabharata and the references related to astronomy in Mahabharata. Scholars have identified over 150 astronomical references in Mahabharata and pre-Mahabharata Vedic Literature of which 70 references are in the book of Mahabharata alone. These vivid astronomical records of celestial inscriptions are those that can be subjected to astronomical calculations and their dates can be ascertained by going back with the help of computer simulations. In the preamble to the colloquium there is a Mahabharata reference on Rishi Vedvyas, stating that –

**"…*day in and day out he* (Rishi Vedvyas) *is watching from the banks of the River Sarasvati the planetary positions on the skies*."**

His night-sky observations of over 70 planetary events are said to be like the astronomy records of celestial inscriptions.

Assuming that the orbits of planets have not changed significantly in the past 5,000 years, the modern astronomical calculations can take us, within acceptable accuracy, to 5,000 years ago to generate the astronomical map of the sky, predicting the planetary positions. An astronomer can shed more light on the subject as to what the sources of error are in determining celestial inscriptions 5,000 years in the past; however, a simple conclusion is that all variable parameters that constitute the orbit of a planet remain sources of error. We know that the time period of a planet for orbiting around the Sun is unchanged with time, but how fixed is it over 5,000 years is not known with 100% accuracy. Also, the period of a planet may be assumed to be invariable but its linear speed along its entire orbital path is variable, and affected by the gravitation of other planetary bodies in their respective orbits. The highest variation in planet's linear speed occurs when it is in the vicinity of the Sun. A planet's speed is accelerated from a given point on the orbit as it approaches the Sun and is decelerated from another point on the orbit on the far side of the Sun. In Vedic astronomy (in Surya

Siddhant, Chapter 2) these positions/motions are defined by *sheeghr-uchch* (point from where motion increases), *mand-uchch* (point from where motion decreases). All planets are affected by this gravitational effect and it relates to their time periods and their orbits. Nevertheless, when all possible sources of error are accounted for the computer simulation would create a fairly accurate sky inscription. This is what was done using the latest computer algorithms by the astronomers who presented their results at this conference.

At the conference Dr. B. N. Narhari Achar, from the Department of Physics, University of Memphis (USA) gave a brief description of the various available planetary softwares and also reviewed the related work of other astronomers and astrophysicists. He critically examined the limitations and reliability of the simulations and the validations of Rishi Vedvyas' astronomical recordings in Mahabharata. He concluded that there was overwhelming astronomical evidence that the Mahabharata War took place about 3,000 BCE and the simulation of planetary events pointed to 3067 BCE, the latter figure being identical to the one derived by the astronomer Dr. Srinivasa Raghavan. The other number in this range was from P. V. Holey who based his comparative study of crucial events of planetary positions of astronomical dates in the reference frame of *nakshatra*, Julian and Gregorian systems. His conclusion was that the Mahabharata War began on the 13$^{th}$ day of November in 3143 BCE. The author of this book, based on the historical records found in Shankaracharya Mathas and genealogical records of the kings at Hastinapur recorded in Satyarth Prakash, which are discussed later in this chapter, placed the Mahabharata War on the Timeline-A in Figure 3.1 at the time-milestone Marker-4 at 3140 BCE. The differences between this author's time-milestone and the above numbers from the astronomers respectively are: -140, -73, +3 years. These differences over a span of 5,000 years respectively are: 2.8%, 1.5% and negligible.

Regarding the existence of the River Sarasvati the book of Mahabharata itself states that the River Sarasvati was in the process of disappearing into the desert. At this conference there was a demonstration of modern technological tools such as Planetarium Software, *Panchang* Software compiled by a Japanese professor to produce the dates in Kali Yuga Era and relate them to Christian/Common Era. The overview of the conference is presented by Dr. S. Kalyanaraman.

Based on his astronomical analysis Dr. B. N. Narahari Achar presented the list of the following 11 dates that are consistent with the sky inscriptions observed by Rishi Vedvyas and laid down in the form of *shlokas* in the book of Mahabharata that Rishi Vedvyas and his students authored more than 3000 BCE. Based on what was mentioned earlier and the discussion that will follow the figure of 3000 BCE is close to the estimate 3067 BCE based on historical data of Table 3.3.

**Dr. Narhari Achar's list includes the following:**

1. Krishn's departure in Revati-nakshatra (Revati constellation) on September 26, 3067 BCE. (Revati the 26th Vedic constellation is ζ Piscium in Greek).
2. Krishn's arrival in Hastinapur in Bharani-nakshatra on September 28, 3067 BCE. (Bharani the 28th Vedic constellation is μ Arietis in Greek).
3. Solar eclipse on Jyeshtha amavasya (new-moon day of the Vedic 3rd month) on October 14, 3067 BCE.
4. Krittika full moon, lunar eclipse on September 29, 3067 BCE (Krittika is 7th Vedic month).
5. Mahabharata War starts on November 22, 3067 BCE with the planet Shani (Saturn) in Rohini-nakshatra and Brihaspati (Jupiter) in Revati-nakshatra. (Rohini the 2nd Vedic constellation is α Tauri Aldeboran in Greek and Revati the 26th Vedic constellation is ζ Piscium in Greek).
6. Winter solstice on January 13, 3066 BCE.
7. Bhishm's expiry on January 17, 3066 BCE.
8. A fierce comet in Pushya, October 3067 BCE.

(Pushya the 6th Vedic constellation corresponds to the 10th Vedic month Pushya. Pushya constellation is δ Cancri in Greek).

9. Krishn's brother Balaram starts his pilgrimage along the shore of river Sarasvati on. Pushya-day on November 1, 3067 BCE.
10. Balaram returns from pilgrimage on Sravana-day on Dec. 12, 3067 BCE.

(Sravana the 21st Vedic constellation corresponds to the 5th Vedic month Sravana.
The Sravana constellation is α Aquilate Altair in Greek).

11. On the day Ghatotkachch was killed the Moon rose at 2 AM, December 8, 3067 BCE.

All these and the rest of the astronomical references in Mahabharata can specifically be pointed out in terms of Mahabharata's *shloka* number, chapter number and *parv* name. To relate just one, the most important of all from the above list is the 7th when Bhishm died. It is based on the two *shlokas*, 23rd and 25th of the 32nd chapter in Anushasan-parv. The two important observations related to this event are: the Sun has retreated northward and the corresponding date in luni-solar Vedic calendar given in these two *shlokas* transcribes to *shukla ashtami* (8th day of the bright-phase of the Moon) in the month of *Magha* (11th Vedic month) in *Rohini* constellation.

These of course are no ordinary observations of a religious nature that can be ignored. They are hard-core astronomical records that could be the oldest available and most reliable in ancient practical astronomy. There are some other rare astronomical events mentioned in Rishi Vedvyas's Mahabharata: The lunar-solar-lunar eclipse sequence occurring within a period of one month and one lunar-solar eclipse sequence occurring within just 13 *tithis* (lunar days).

Several different software packages were applied to simulate the sky 3000 years BCE and the results were presented and discussed at this conference. With due consideration to the variation in the results it was concluded that the Kurukshetra War (i.e. Mahabharata War) occurred around 3000 BCE and is a historical fact. The above conclusion on the historicity of the Mahabharata War that did take place about 5,000 years ago is based on the scientific methods presented at the above mentioned conference and the recorded ancient Vedic astronomy included. This leads to the proof that the references from the book of Mahabharata are at least as old as the book itself. The references for Vedic Cosmology drawn in this

book from the four Vedas, Brahmana-books, Smriti and the six Sutras (Darshans) are in the antecedent of Mahabharata. Therefore, it can be said with confidence that this author's Vedic Reference Hypothesis, laid down right at the onset of this chapter that- *"The basic Vedic references on cosmology are ancient and precede 5,000 years"* is proven within the acceptable error. The time-milestone at Marker-4 on Timeline-A of Figure 3.1 which this author placed at the year 3140 BCE is also very close to the reality. The difference between the time of Marker-4 based on ancient Indian calendars and the conclusion based on astronomical calculations drawn at the said conference is only 140 years over a span of about 5,000 years. The error if any is only 2.8 %, which is quite acceptable in historical deductions and is even acceptable in most scientific methodologies. Therefore the Reference Hypothesis is fully validated beyond doubt.

This author feels that it would be of interest to a reader to read some anecdotal information about the legendary River Sarasvati. Also it is of interest to analyze a few more pronouncements of King Manu in his book Manusmriti.

## Folklore and Legends about the River Sarasvati

The oldest reference to the term *sarasvati* is in the oldest book of Vedic Literature, the RigVeda (1/3/10-12). The term also appears in YajurVeda and AtharvaVeda. All terms in the Vedas are *yaugik*, signifying only the meaning of the root, indicating aspects of knowledge, not a physical objet. The etymology of the *yaugik* term *sarasvati*, which stands for 'intellect', is in Chapter 4. In rest of the Vedic Literature the term *sarasvati* appears generally in *rudhi* sense, the colloquial usage for concrete (physical) objects. In addition to the *rudhi* application in Manusmriti for the River Sarasvati, the Shatpath Brahmana (1/4/1/14), the commentary book on YajurVeda, also uses the term *sarasvati* for the same river. Using *yaugik* terms of the Vedas to name persons and objects of *rudhi* nature is a common practice in the Vedic religion. The mighty river with five tributaries being named Sarasvati was the most appropriate name for a river, the waves of which inspired *rishis* to create *chhandas* (vibrations) of knowledge that led to the composition of poetic *mantras* and the *sutras* of the Vedic Literature.

This Shatpath reference relates to the conversation that took place in the far antiquity of Aryavart '*at the shore of River Sarasvati*', between the King Videgh Mathav and his *purohit* (priest) Raahugan Gotam. It relates to *vaishvanar-agni* that takes on the form of *daavaanal-agni*. *Vaishvanar* and *daavaanal* are epithets of energy (*agni*), the former being the chemical energy and the latter being the fire that burns substances. An immediate example of the *vaishvanar-agni* is the chemical energy used in the digestion system in a living-being and the example of the *daavaanal-agni* is an ordinary wood-fire. So, a forest-fire is generally referred to as *daavaanal-agni*. There are a few sources of starting *daavaanal* fire in a forest, such as the friction in dry wood or lightning; however in this Shatpath Brahmana narration the chemical *vaishvanar* energy started the forest fire. This and subsequent Shatpath narrations give a glimpse into the ancient history of Aryavart. Word for word, English translation by this author, preserving the Shatpath style, goes thus:

> "The *king Videgh Mathav at that time was at the shore of the River Sarasvati. At that time the fire continued burning and moving towards the east. Gotam Raahugan and Videgh Mathav followed that burning fire. The fire dried all rivers in its way. One river named Sadaneera originates from the North-Mountain. The fire could not dry up this river. The brahmanas* (learned people) *had never crossed it before"*. (Shatpath, 1/4/1/14).
>
> "*But now many brahamans live east of this river. Earlier the land east of Sadaneera was uncultivable and was lying vacant. It was full of daldal (quick-sand) because the fire had not tasted it*". (Shatpath, 1/4/1/15).
>
> "*Now of course it is very fertile because the brahmans have performed yagjya on it and have given its taste to the agni (fire). It (*River Sadaneera) *has strong flow even during the onset of summer season. Vaishvanar-fire had not burnt it* (because the forest fire did not cross the River Sadaneera). *Therefore this region is very cold*. (Shatpath, 1/4/1/16).
>
> *"Videgh Mathav addressed the agni – where am I? The agni* (the energy of thought process) *replied – "Let there be your home on the*

*east side of the river". Up till this day this river forms the boundary between the geographic regions of Kosal and Videh. People (in Videh region) are addressed as Videh because they are the descendents of Vedegh Mathav*. (Shatpath, 1/4/1/17).

There are several evident and mysterious aspects of the above Brahmana narrations. In their conversation the King Videgh Mathav and his *purohit* (priest) Raahugan Gotam differentiate between the two classes of energy and also, one energy initiating the other. They talk about severe forest fire that engulfs a large region and dries rivers in its swath. It is mysterious because severe forest fires do break out in modern times but none are able to dry up a river. The obvious observation in these narrations is the westerly wind system moving the forest fire from the River Sarasvati towards the River Sadaneera forming the boundary between the well-defined regions that exist on the Indian sub-continent even today. The literal meaning of the River Sadaneera is – 'the *river always with water*', as emphasized in the Shatpath narration as well.

It is discussed in Chapter 4 that the city of Ayodhya was established as the capital of Kosal kingdom by King Manu. The geographic regions of Kosal and Videh already had their names and therefore were part of Aryavart's ancient history. In the Shatpath narration the geographic region of Kosal begins from the west shore of the River Sadaneera. Ayodhya the capital of Kosal established by Manu is in fact situated at the west-shore of the river named Sarayu. Since Ayodhya has not changed its location it is possible that Sarayu is the changed name of the River Sadaneera. Since there is no mention of Manu or Ayoddhya in Shatpath narration the Videh kingdom may have been established by the King Videgh Mathav and his *purohit* Raahugan Gotam. This Gotam could be Rishi Gautam the author of Nyaya Darshan, the oldest of the six Vedic Sutras. Generations later in Manu's genealogy, the prince Ram of Kosal region had married Sita the princess of Videh Kingdom which was ruled at that time by her father who was known as Videh Janak. It can be deduced therefore that Videh Janak known in Vedic Literature as the king with high intellectual pursuits and having deep Vedic knowledge, was a descendent of King Videgh Mathav. The reference to philosophic dialogue (*samvaad*) between King Janak and the *rishis* is well-known in Vedic Literature.

The Shatpath narration between King Videgh Mathav and the *purohit* Raahugan Gotam makes it obvious that the River Sarasvati was a reality in the ancient past of Aryavart and that the geographic regions of Kosal and Videh were subsequently situated to the west of Sarasvati in the same order as narrated in the ancient book of Shatpath Brahmana and exist in the same order today. The difference however is that the major river flowing north-west of Ayodhya, between the regions of Kosal and Videh is River Sarayu (meaning- *dynamic like the wind*) and not Sadaneera (meaning - *river always with water*) named in Shatpath.

## The Triveni Sangam

The River Sarasvati continues to be a legend for present-day Hindus of all strata. The most common legend of all is that the Invisible Sarasvati still flows and meets the famous rivers Ganga and Yamuna at their confluence near the city of Prayag. Although there is no sign of a third river at Prayag, the confluence of Ganga and Yamuna at Prayag has been known since time immemorial as the Triveni Sangam (confluence of three rivers). It is one of the important pilgrim places for the Hindus.

Let us now explore the possibilities of why the Ganga-Yamuna confluence is named Triveni Sangam (confluence of three rivers). In contexts of the discussion on River Sarasvati and the rediscovery of Sarasvati and Palaeo-Yamuna by the scientists, let us analyze first the term *yamuna*.

This author finds the meaning of the name Yamuna fascinating. The etymology of the term *yamuna* yields – '*one that moves in association with others and one that also moves separately'*. A major river generally stays its course year after year till a severe plate-tectonic event changes its course. Therefore, it is puzzling as to why the Aryans would give Yamuna a name that represents contrariety within itself? The question has no simple answer. However, in view of the new geological investigations and studies of land satellite imagery during 1980's and 1990's some light could be shed on this puzzle. As stated above, the multifaceted science investigations have achieved the mapping of the drainage system in North-West India, determining the past course of the rivers that still continue to flow, those that changed their course and those that are extinct now.

The analyses of ground and satellite data by eminent scientists show that at one time in the distant past, the River Yamuna, originating from its source named Yamunotri at 3,307 meters above sea level in the Himalaya, flowed south-west to drain into the now extinct River Sarasvati (Figures 3.4, 3.5). Therefore the Yamuna was Sarasvati's tributary and the Yamuna water flowed in Sarasvati. The ancient course of Yamuna between Yamunotri and the rediscovered Sarasvati was shown as Palaeo-Yamuna channel in the Figures 3.4 as well as in 3.5. Then a severe cataclysmic plate-tectonic event took place in the distant past changing the topography in the Shiwalik Hills, separating Yamuna from Sarasvati and turning Yamuna to assume its present south-east course of 1,384 km beginning at Yamunotri and ending at Triveni Sangam in Prayag where it offers all of its water to the River Ganga. Owing to the said cataclysm, the Aryans of the distant past who lost Yamuna from their region, suffered from the ensuing upheaval, were uprooted and must have followed Yamuna's new course looking for new settlements. Based on that observation and perhaps many centuries later the learned *rishis*, under the advanced Aryan system of knowledge-transfer, must have named it Yamuna. There is always a reason for an entity receiving a specific and meaningful name in Sanskrit. The contrariety in the meaning of the name Yamuna, '*one that moves in association with others and one that also moves separately'* is now obvious. Yamuna moves in association (with Sarasvati) and Yamuna also moves separately (from Sarasvati).

Similarly it is explicable as to why Prayag was named the Triveni Sangam, the *place of tri-river confluence*, the three rivers being Ganga, Yamuna and Sarasvati. Owing to geological reasons mentioned above when Yamuna broke off from Sarasvati, the water that would have become a part of Sarasvati was brought to Prayag by Yamuna. Later the entire River Sarasvati went extinct, however, the Prayag's adjective Triveni Sangam continued. The *rishis* must have travelled and studied the ecology of the region and surveyed the land before addressing Prayag as the Triveni Sangam. The invisible Sarasvati's water, now part of the visible Yamuna, flowed into River Ganga at Prayag, hence the name: the Triveni Sangam, the tri-river confluence.

Naming of a big river with a single name and characteristics reflected in that name cannot be given by the common folks living at the shores of that river. For example the river name Yamuna could only come from a

learned person because the term '*yamuna*' conveys the characteristics of 'association' and 'dissociation'.

The river Yamuna in Yamuna because it has the association with the River Ganga and the dissociation with the River Sarasvati. Being astute thinkers the *rishis* encompassed geological history also in the nomenclature. Such finalization in the name of an entity of nature does not take place in a generation, in a century or even in many centuries. This is why the nomenclature of entities in Aryavart is remarkable and indicates the ancientness of the Vedic culture and its literature.

In the second *shloka* of 22nd *sarg* (section) of Baal Kaandam (first chapter) of Valmiki Ramayan, the River Ganga is referred to as '*tripathgaam*', meaning the '*one that has gone on three paths*'. The explanation behind this adjective for Ganga in Ramayan conveys that Ganga at *triveni sangam* has come together after following the three paths, the paths of Sarasvati, Yamuna and Ganga. This is no ordinary assertion.

The decisions made by the *rishis*, based on their long-term observations and the study in ecology and geology were respectfully accepted by the Aryans and firmly ingrained in Hindu psyche. Consequently, along the entire course of the major rivers, over thousands of years, the Ganga is still called Ganga, and Yamuna is called Yamuna even after numerous kings ruled from their shores. The kings also respected the decisions of the *rishis* and did not name and rename the great rivers after themselves as the rivers flowed through their respective kingdoms.

We will not take up here the three other nation-defining s*hlokas* of Manu (1/136, 1/140, 1/141) and the Vinshan Region metioned in Manusmriti, instead present a few extraordinary discoveries from Manusmriti.

In the Ramayana-Baal-Kaandam (3/1-3) Rishi Valmiki states that -'*At the banks of Saryu River the geographic region known as Kosal was full of prosperity and wealth with contented citizens. There the great king of people, Manu, had established the city of Ayodhya as his capital'*. Obviously there was no Ayodhya before Manu. As stated in Valmiki Ramayana (29/18), the first king after Manu, who ruled from Ayodhya was Manu's son Ikshvaku. It is likely that Manu came from another region of Aryavart to Kosal region and re-established his kingdom Ayodhya on the bank of the Saryu River; which could be the ancient Sadaneera.

The reference of one book in another book plays a significant role in determining relative historicity of the books. Rishi Valmiki in several shloka couplets of Ramayana encapsulated an interesting discussion between Ram and a ruler of a forest region in south India, which reflects this point. Ram, journeying through the forests of south India during his fourteen-year exile from Ayodhya, reached the Pampa Sarovar (Pampa Lake) where he met Bali the ruler of Kishkindha (360 km north-west from the city of Bangalore). In a dialogue between the two, Ram the follower of *dharma* (laws of moral and justice) unhesitatingly pointed out to Bali his unjust and immoral behaviour towards his younger brother Sugreeva by reciting two *shlokas* from Manusmriti on the subject of 'crime and punishment' and a king's duty in rendering the appropriate punishment. Before reciting the two specific *shlokas*, Ram addresses Bali, as in the Valmiki Ramayan *shloka* (Kishkindha Chapter, 13/20) - "(O Bali) *listen to what Manu has instructed in the two often cited shlokas wherein he established the rule of proper conduct. Most scholarly of righteous character accept it and I too follow it*". Then Ram recited to Bali the two *shlokas* of Manusmriti (8/318 and 8/316), in that order, 318$^{th}$ *shloka* before the 316$^{th}$. These two *shlokas* of Manusmriti correspond to the two *shlokas* of Ramayana (Kishkindha, 13/21 and 13/22), with minor change in terminology. In the second line of Manu's *shloka* (8/316), Valmiki used his own poetic expression with a change of a few words, yet conveying the same meaning. This establishes the chronology between Manusmriti and Ramayana.

Ramayana also makes it obvious that even during Ram's time the city of Prayag, an important east point of the Central Region of the Aryavart, has been the confluence of the rivers Ganga and Yamuna. This places Ramayana after Manusmriti and conversely there is no reference of Ramayana or Mahabharata in Manusmriti.

The roar of the magnificent River Sarasvati is absent now. Any cataclysmic event that silenced its roar leading to its slow disappearance had to have occurred after the nation acquired its name Aryavart. In Manu's Aryavart are Prayag, Sarasvati, Drishdvati, Vindyachal, the region with the sea on the east and west. If the Aryans have come from outside India they must associate themselves with landmarks such as these. The fact is that no such place exists on the Earth elsewhere but in Aryavart (India). Therefore Manusmriti's Brahmavart is within Aryavart, the home of the Aryans the

Bharatvarsh of today, which unfortunately is now addressed with mediocre and meaningless names, like Hindustan and India. On one hand we have Manusmriti's references, scientific research on River Sarasvati and the above logical discussion on the historicity of Aryavart and on the other hand we have the far-fetched Aryan Invasion Theory proposed by Western Indologists. Therefore, the AIT must be shunned by honest intellectuals because it is not based on an honest intellectual examination of history and instead was a byproduct of a judicious mixture of ulterior motives and ignorance. Other concocted hypotheses related to the Vedas, Vedic Literature, Vedic culture and history should also meet the same fate.

There are several other *shlokas* in the same chapter of Manusmriti that go beyond the geographic definition of Aryavart. These *shlokas* indicate the kind of people who lived in Aryavart and differentiate between the people living in Aryavart and those living in geographic locales outside Aryavart. The *shlokas* also give an insight into the knowledge pool of the people of Aryavart relative to not just its surrounding areas but the rest of the world.

## A Remarkable Discovery from Manusmriti

Two *shlokas* from Manusmriti presented in the following also show that Aryavart has been the place of the Aryans from the very beginning, where they have indigenously developed their social structure and civilization. They developed knowledge not just in spirituality and philosophy but had wide knowledge of the sociology of the region well beyond the boundaries of Aryavart. Manusmriti, Mahabharata and other Vedic writings, including the Puranas variously tell us that the ancient Aryans of India had knowledge of the world and about the different people who inhabited it. Just two *shlokas* from Manusmriti are presented here to

demonstrate the knowledge of the Aryans about the status of global ecology and education. All this awareness and the process of knowledge-gathering beyond the boundaries of Aryavart at such an early stage in the human history should send thinkers back to the blackboard to redefine human history.

Manusmriti's *shloka* (1/142) states:

कृष्णसारस्तु चरति मृगो यत्र स्वभावत: ।
स ज्ञेयो यज्ञियो देशो म्लेच्छदेशस्त्वत: पर: ॥

(Manusmriti, 1/142) **Transliteration:**
"*Krishnsaarastu charati mrigo yatr svabhaavatah* । S*a gjeyo yagjiyo desho mlechchhadeshastvtah parah* ॥)

**Shloka Translation:**

"*And in the country where the most brilliant vigorous blackbuck grazes freely and fearlessly, inhabited by the yagjyiya people, know it to be that country (Aryavart) and beyond which are the countries inhabited by mlechchha*". (Manusmriti, 1/142).

It may not be obvious immediately that this *shloka* deals with two different subject areas which are well-advanced in modern civilization: the science of world ecology and the world sociology. What has just been said may seem far removed from the two disciplines just quoted, however, the following discussion will show that the statements in the above *shloka* are very close to this author's assertion. This requires a brief interpretation of the *shloka* and this author hopes that the reader will value the validity and depth of the *shloka*. Let us discuss the second line of the *shloka* first.

## Mlechchha-Countries of Manusmriti

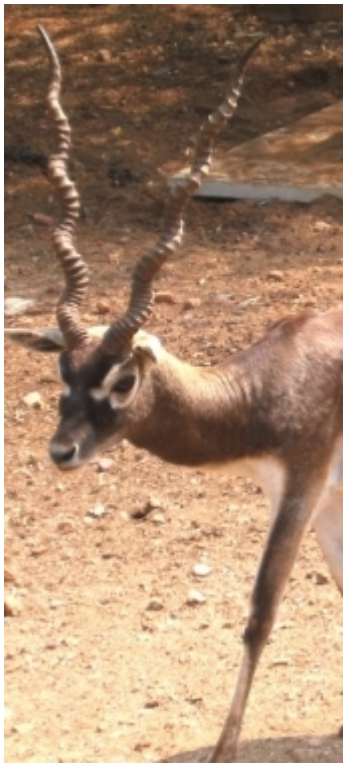
There are two provisos in the second line of the *shloka* – that the Aryavart is inhabited by the *yagjyiya* people and the countries outside it are inhabited by *mlechchha* people. Therefore, it is self-evident that in this line of the *shloka* there is a comparison of the people of Aryavart with people living outside Aryavart.

The word *yagjya* (syllables g and j pronounced together) is a noun which is popularly written as *yajna* and wrongly translated by European

scholars as 'sacrifice', the connotation of which has no place in Vedic philosophy and therefore is fallacious. The basic definition of the word *yajna* (*yagjya*) is: - '*any action requiring association of men or objects, and productive of beneficial results'*. Such an action is for the benefit of all living beings whereas the connotation in the term 'sacrifice' generally conveys the sacrifice of some being(s) for the benefit of others. Therefore a *yajna* (*yagjya*) is not equivalent to 'sacrifice'. There is no single English word that can justify the meaning of *yagjya*. Differently put, a *yagjya* is a sacred 'observance' of an act of non-violence. Thus by definition a '*yagjya'* is a noble deed and therefore is a *dharmic* action. Some examples of *yagjya* in a modern society are: unselfish acts of philanthropy, charity work, environment protection, saving the species and so on. The process associated with *yagjya* is a verb and addressed as *yagjya* as well. The participant or a devoted performer of *yagjya* is addressed as *yagjyiya*. This takes us back to the city named Prayag that Manu mentioned in *shloka* (1/140) and the one vividly described in Ramayana (Ayodhya, 40/1-22). Manu in his above shloka (1/142) is referring to the learned people with the adjective of yagjyiya who have the welfare of others in their mind and are devoted to the almighty Brahmn.

A colloquial connotation of the word *mlechchha* is 'impure and low', however, according to the translations and interpretations by Sanskrit scholars, including Professor Surendra, the word *mlechchha* means – '*one who is not educated and speaks in undeveloped language'*. Manu's implication in his *shloka* is that the high development in education and language uplifts a society leading to the development of philosophy and spirituality. The process of *yagjya* involves the participation of scholarly people having a deeper knowledge of the Veda mantras that are recited on the occasion of the act of *yagjya* for the collective benefit and upliftment of the society. In Manu's thinking the absence of *yagjya* in the society leads to selfishness and materialism. The context of his *shloka* indicates that Manu made a sociological comparison of the high development of the Sanskrit language in Aryavart and the relatively poorly developed language skills outside Aryavart.

## The Blackbuck of Aryavart



In the above *shloka*, the expression – "*the most brilliant vigorous blackbuck grazes freely…*" in Aryavart, gives the impression that Manu in his nation-defining *shlokas* wanted to bring in some added poetic beauty to Aryavart by mentioning its pastures and the animals that grazed there. When one looks carefully at this *shloka*, one finds more in it than just that. This author observes that Manu in this *shloka* has only mentioned a specific species of blackbuck. So, there is an indication of the association of a specific species of deer and the people of Aryavart which is a relationship between the society and the ecology of Aryavart. Since Manu in this *shloka* draws a comparison between Aryavart and other nations exterior to it, Manu's *shloka* is a statement on global ecology. The mention of this species of deer in the *shloka* is the reason for the earlier heading "A Remarkable Discovery from Manusmriti". This deduction is supported by recent ecological observations discussed below.

Let us first look at the meanings of some terms in the first line of the *shloka*:

*Krishnsaarastu = Krishn + saarah + tu*

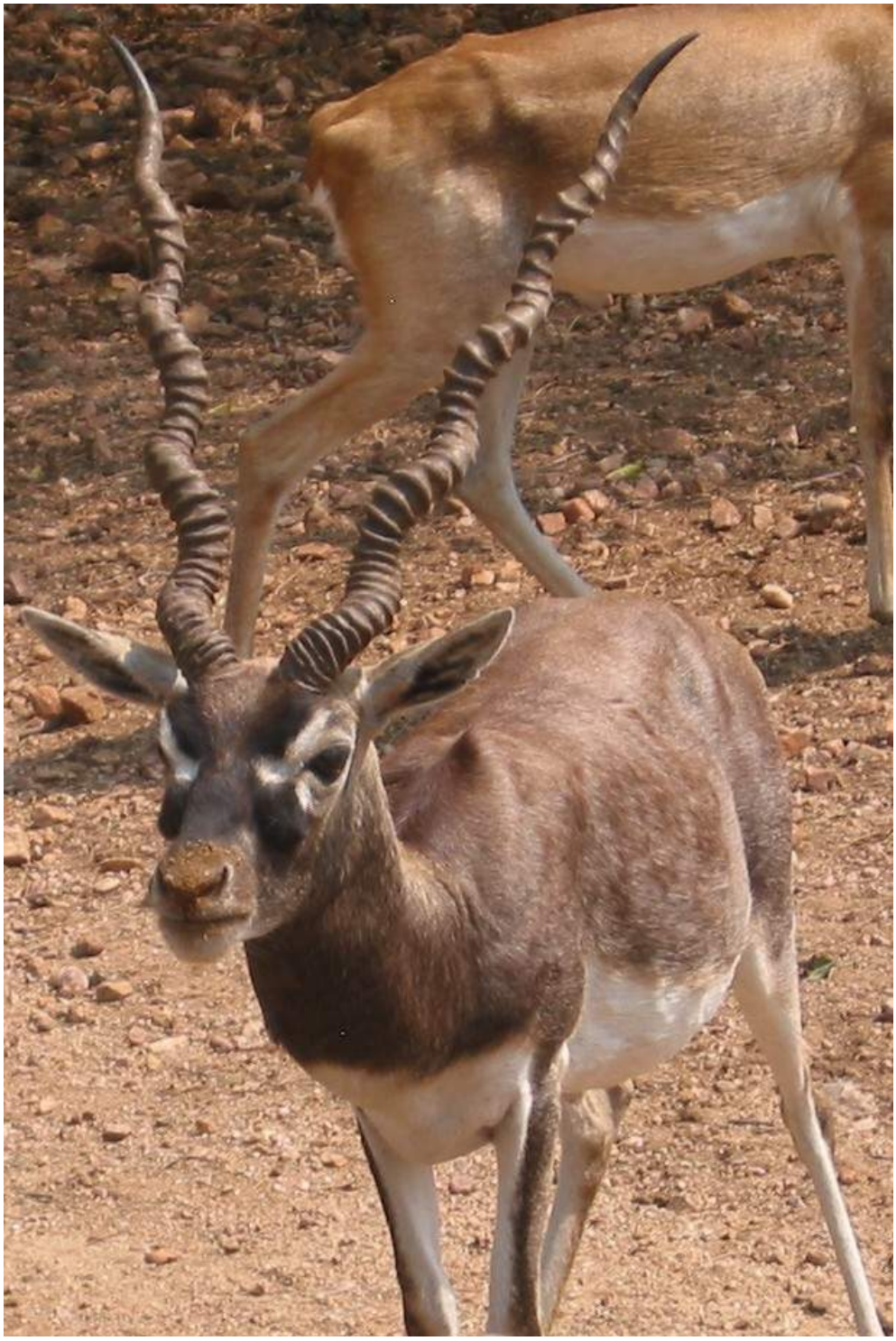
*Krishn* = root meaning is 'who attracts all', common meaning is 'black'

*saarah* = has several meanings: most brilliant, genuine, real, extract, strength, powerful, energetic; *tu* = and;

c*harati* = moves, walks, roams, grazes;

*mrigo*= deer, buck; *yatr* = where, at the place; *svabhaavatah* = freely, naturally, without fear.

The emphasis in Manu's *shloka* is quite obvious that it is Aryavart where people with adjective of *yagjyiya* live with welfare in their thought and action enabling the coexistence of all living beings including one of nature's beauties - the *most brilliant vigorous blackbuck* that *grazes freely and fearlessly* in Aryavart's pastures. Implicit in the *shloka* is that in the other countries there was no blackbuck or if it did, it was extinct. That the blackbuck is not in other countries or if it is there it does not roam free, is a generalization which Manu can claim only when he has the ecological information about the region exterior to Aryavart. This is what can be easily deducted from this *shloka*.



In this *shloka tu* and *yatr* together mean '*and in the place where*' with the reference of *Aryavart* in the previous *shlokas*. The *krishn-sarah* or *krishn-mrig* of Manu's *shloka* is popularly known in India as the *krishn-mrig, kala hiran* or *krishn-jinka*. The English

name for it is blackbuck (antilope cervicapra). Blackbuck still exists in India and is a protected animal under the Wildlife Protection Act of 1972. Killing it is a crime punishable by law. This species was near extinction but is now protected in its natural habitat, in sanctuaries and national parks of India. Hunting or killing a blackbuck is a un-*yagjyiya* act punishable with a jail term.

The pictures of the blackbuck in this text here are from the Mahavir Harina Vanasthali Park near Hyderabad City in the state of Telangana where the blackbuck is protected and declared to be the State Animal. The reference of the blackbuck in Manusmriti and its association with Aryavart is no ordinary statement by Manu. Here is why.

This author while learning about the blackbuck gathered that in recent times the scholars in geography and ecology have published a large number of papers on the blackbuck and its habitat. One striking fact emerged from these publications is that the blackbuck is **native to India only**. No scholar of ecology or geography today can state this fact without having global ecological knowledge. By the same token Manu could not have generalized that it is only in Aryavart where the blackbuck roamed freely in its natural habitat, unless he had global ecological knowledge on the species of animals. It is easy to gather global ecological information in modern times with the entire world connected through global travel and information technology. It is mind-boggling how Manu would have developed knowledge on global ecology, particularly on the blackbuck's habitat, that it lived only in Aryavart where *yagjyiya* people lived and where the blackbuck roamed freely.

Just as an ecologist of today would have to have knowledge of global ecology before he could deduce that the natural habitat of the blackbuck is only in India, so also, Manu had to have knowledge of global ecology before stating that same fact in his Manusmriti, millennia ago. The above *shloka* alone shows that he is not making a fleeting reference to some animal, any animal, but he specifically chose the blackbuck because he show-cased a unique ecological difference between Aryavart and elsewhere and also the sociological difference between the people of Aryavart and elsewhere. If there were blackbuck elsewhere and if there were people outside India with Sanskrit language and with *yagjyiya* discipline, he would be wrong to state what he has stated in the *shloka*. Manu within a single *shloka* differentiates Aryavart from other countries by connecting a specific species of animal to the Aryan people, exhibiting a remarkable universality in his knowledge. He could have mentioned other animals like an elephant, a horse or a cow but instead he chose an animal unique to Aryavart. The cow, for the people with *yagjyiya* discipline practising non-violence, is a holy animal and is considered to be the most beneficial animal to humans. But Manu in his *shloka* chose to cite the blackbuck with its exclusive existence in Aryavart.

Originally spread out over large tracts of open Gangetic plains (planes of River Ganga) of India, the blackbuck continues to be mainly in the States of Punjab, Haryana, Rajasthan and Gujarat which together are in the plains of the ancient River Sarasvati. The blackbuck is also found in other states of India and in a limited number in Nepal. In modern times, it was introduced for the first time into Texas (USA) from India and also into Argentina in the early 1900 CE. A thorough study of unpolluted Manusmriti would

yield that a rich knowledge-base in varied disciplines has been the foundation for its creation.

The discovery by modern ecologists that the blackbuck has been native to India is a confirmation of what Manu laid down in his Smriti eons ago before Mahabharata. Manu could not have had this knowledge without him and or other scholarly observers of ecology and sociology traversing the globe! The startling fact on this comes from the five thousand year old *shloka* in the book of Mahabharata in its Shanti-Parv section, which indicates that Manu himself observed the ecology of the world and the people outside Aryavart before laying down the nation-defining *shlokas* in his Manusmriti.

In the book of Mahabharata the Grandfather Bhishm from his deathbed preached about the duties of a good king to the victorious Yudhishthir. He gave the example of the ideal ancient King Manu. Among several *shlokas* on this subject comes a *shloka* stating that:

ततो महीं परियययौ पर्जन्य इव वृष्टिमान्।
शमयन् सर्वतः पापान् स्वकर्मसु च योजयन्॥
(Mahabharata, Shanti-Parv, 18/14).

**Transliteration**:
"*Tato maheem pariyayau parjanya iv Vrishtimaan*.
Shamyan sarvatah paapaan svakarmsu cha yojayan."
**Translation**:
*"Then, accepting the request of his subjects, the Emperor Manu, like a cloud with cooling effect, roamed the entire Earth preaching discipline, duty and good karma to people for planning a just society"*. (Mahabharata, Shanti-Parv, 18/14).

The *shlokas* couplets in Manusmriti are no ordinary facets of literature, poetry or religious preaching. They actually lead one to uncover ancient facts. In addition to the significant observation of the blackbuck that this author has highlighted, Manusmriti also contains many mind-boggling facts related to science and society. An example of time-unit *nimesh* (1 *nimesh* = 8/45 second = 177.8 milliseconds) was presented in Chapter 1 and discussed in Chapter 5.

Manu's statement that "*the most brilliant vigorous blackbuck grazes freely…"* in Aryavart also sheds some light on the sociological makeup of the Aryans of Manu's time. The *yajna* being an act of nonviolence, the killing of animals at the time of *yajna* or sacrificing of animals in a *yajna* fire is inconceivable because doing so would be considered a bad karma and sinful. Not just for karma but for the purity and health of the physical body, Manu in the fifth chapter of Manusmriti has devoted a large number of *shlokas* on the subject of *bhaksh-aabhaksh* which means - '*edible – non-edible and what-not-to-eat*'. There he has made it abundantly clear that violence towards animals is an act of *a-dharma* (immoral and irreligious). Without discussing it in detail one *shloka* of Manusmriti is presented in the following that confers logic for practicing non-violence towards animals.

नाकृत्वा प्राणिनां हिंसा मांसमुत्पद्यते क्वचित् ।

न च प्राणिवध: स्वर्ग्यस्तस्मान्मांसं विवर्जयेत् ॥

(Manusmriti, 5/48)

**Transliteration**:

"*Naakritva praaninaam hinsa maansmutpdyate kvachit |*
*Na cha praanivadhah svargyastasmaanmaansam vivarjyet ||*"

**Translation**:

*"Meat cannot be produced without killing animals and the act of killing being an unrighteous act it does not lead to salvation. Therefore meat-eating is completely forbidden"* (Manusmriti, 5/48)**.**

Manu emphasized that meat eating was immoral because he simply followed the Vedas where the killing of animals and even being unkind to living beings is forbidden. To cite just one example here, a YajurVeda mantra (36/18) states –

दृते दृँ ह मा मित्रस्य मा चक्षुषा सर्वाणि भूतानि समीक्षन्ताम्

मित्रस्याऽहं चक्षुषा सर्वाणि भूतानि समीक्षे ।

मित्रस्य चक्षुषा समीक्षामहे ॥ (YajurVeda, 36/18)

**Transliteration: "***Drite drim ha maa mitrasyaa maa chakshushaa sarvaani bhootani sameekshntaam, mitrasyaa-aham chakshusha sarvaani bhootaani sameekshe| Mitrasya chakshushaa samikshaamahe*॥"

**Mantra Translation**

*"O Illuminator of our minds let all living beings view me amicably and let my resolve be strengthened to view all living beings as friends and to love all living beings as I love myself."* (YajurVeda, 36/18).

With that prayer offered to the Creator one cannot think of killing animals for consumption. This is why the *krishn-sarah mrig,* the brilliant blackbuck, grazed free in Aryavart.

Manusmriti has no mention of Aryans belonging to any other place than Aryavart (India) itself because any other place outside Aryavart belonged to *mlechchhas* with underdeveloped tradition and language. Manu throughout his Manusmriti has never advised to close Aryavart's doors to people from outside; rather he welcomes them with his advice for "all people of Earth to benefit from Aryavart". This is exactly what is stated in Manusmriti (1/139).

एतद्देशप्रसूतस्य सकाशादग्रजन्मन: ।
स्वं चरित्रं शिक्षेरन्पृथिव्यां सर्वमानवा ॥

(Manusmriti, 1/139)

**Transliteration: "***Etaddeshprasootasya sakaashaadagrajanmanah | Svam svam charitram shiksheran-prithivyaam sarva maanavaa* ॥"

**Shloka Translation:**

*"For developing their individual character, knowledge and education all humans of the Earth should receive knowledge from the intellectuals and learned people (the brahmanas) born in this nation* (Aryavart)*,"* (Manusmriti, 1/139).

Manu's emphasis in the above *shloka* is on पृथिव्यां सर्वमानवा (*prithivyaam sarva-maanava*) which translates into '*all people of the Earth*'. Manu welcomed people of other nations to come to Aryavart to gain knowledge. Manu makes no reference to Aryans and non-Aryans within Aryavart. All inhabitants of Aryavart according to Manu are Aryans.

Manu's statement that '*all humans of the Earth*' could learn from the Aryans of Aryavart indicates that the Vedic knowledge is indigenous to India and that all ideas in the Vedas are original to India and therefore the mantras and *sutras* on cosmology and other branches of science and philosophy presented in this book, are indigenous to ancient India. Manusmriti being older than Ramayana and Ramayana being older than Mahabharata, they all are in the past of the time-milestone at the Marker-5 at February 18, 3102 BCE on the Time-line A of Figure 3.1. This discussion based on Manusmriti puts an end to both, the Aryan Hypothesis and the Aryan Invasion Theory.

## Astronomy and Age of the Vedas

Just as the sky inscriptions mentioned in the *shlokas* of Mahabharata led to the period of Mahabharata War and the planetary conjunction yielded the onset of Kali-Yuga period at the Marker-5 on Timeline-A (Figure 3.1) on **February 18, 3102 BCE** at 2 hours 27 minutes and 30 seconds, discussed earlier, many scholars have attempted to determine the historical period of the Vedas based on the statements in the Veda mantras. This is briefly discussed here.

Using the astronomy information in a mantra leading to when the mantra may have been written requires astronomy calculations. The fact is that there is considerable astronomy in the Veda mantras and throughout the ancient Sanskrit Literature to lead to meaningful deductions. An example from Valmiki Ramayana is the citation of sky inscription at Ram's birth (Valmiki Ramayana, Bal-Kandam, 4, 5). Ram was born in the month of Chaitra on $9^{th}$ *tithi* (lunar-day) when five planets (Mercury/Sun, Venus, Mars, Jupiter, and Saturn) occupied their highest elevations in the Punarvasu Nakshatra ($7^{th}$ of 27) when the Moon rose together with Jupiter in the Kark Lagn (Cancer sign). This is quite a detailed inscription for an astronomer to perform a back calculation starting from the present positions of the planets and the Moon.

A Vedic reference on this relates to the "*Nakshatra Sukta*" (Constellation Hymn, 19/7/1-5) of the AtharvaVeda (fourth Veda) which has devoted five mantras for the sequential nomenclature of 28 constellations in the zodiac; 27 of these are presently used in the same sequence in the Indian astronomy as well as in the modern astronomy with Greek names. The same *sukta* (hymn) also instructs to use the Moon in astronomy because, as the *sukta* states, the Moon consistently scales these constellations. This was briefly mentioned in Chapter 1 and more details are in Chapter 11 of this book.

To follow this procedure the minimum condition from the Vedic perspective is that the chosen mantra for estimating the age of a Veda be interpreted correctly. The last thing one should do is to trust the translation of a neo-Sanskritist who relies on *rudhi* rather than *yaugik* meaning of the Vedic terms. The Vedic year's first month always begins near the vernal equinox on the first day after the full moon day. Therefore, to apply this knowledge of astronomy one needs a clue in a Veda mantra that is related to a constellation and the beginning of the Vedic year. Since the occurrence of vernal equinox keeps shifting on the celestial equator (a 360 degree circle) towards the next constellation at a rate of 1 degree for every 72 years, it will take 960 years for it to be located in the adjoining constellation. At this rate the vernal equinox will occur again in the same constellation completing a full circle of 360 degrees covering all 27 constellations in 25,920 years. The reason for this change is the wobble of the Earth's axis, also known as the precession of the equinox, which in Indian astronomy is "*ayan chalan*".

This methodology based on astronomy to ascertain the age of a mantra is then extended to finding the difference between the constellation mentioned in a mantra and the present constellation at the beginning of the Vedic year. The assumption in this method is that the mantra was written in the constellation mentioned in the mantra. This assumption is not scientific because within a mantra of the Constellation Hymn of the AtharvaVeda one can count at least 5 constellation names, which should take 960x5 years just to write one mantra. To write all mantras of the Constellation Hymn to include all 28 constellations, one needs 25,920 years. This does not make any logical sense. However, some very reasonable arguments have been made suggesting the age of the Vedas.

The eminent German Indologist Hermann Georg Jacobi (1850–1937) used the astronomical information in some Veda mantras to determine the true local time and based on the available inscriptions he suggested that the RigVedic hymns were composed as early as 4500 BCE. When he published his views in the Journal of the Royal Asiatic Society in 1908, the proponents of "Out of India Theory" welcomed them and the proponents of AIT suggesting Aryan invasion about 1500 BCE, were furious.

Bal Gangadhar Tilak (1856-1920) was a scholar of Indian history, Sanskrit, Hinduism, mathematics, law and astronomy. In his book titled 'Orion', he interprets a RigVeda mantra from 86$^{th}$ *sukta* of its 10$^{th}$ *mandala* (chapter) as having the vernal equinox in the constellation of Mrigsheersha (meaning Head of Deer). In his time the occurrence of the vernal equinox was in the constellation of Uttar Bhadrapadaas, six constellations ahead of Mrigsheersha. This is equivalent to 5,760 years which is about 4,000 BCE, which he estimated to be the age of RigVeda. This alone negates the AIT and Max Muller's age estimate of the Veda. Tilak's conclusion sets an arbitrary upper limit of about 6,000 years on the age of the Veda and the Vedic Civilization. But nothing stops one from extending the argument that the RigVeda was written in one of the previous cycles of vernal equinox yielding the age of RigVeda as 25,920 + 6,000 = about 32,000 years or 32,000 + 26,000 = 58,000 years and so on. The fact is that there is no clear indication of vernal equinox or even the said constellation of Mrigsheersha in the 86$^{th}$ sukta. Therefore, such scientific calculations are of value only when they are supported

with the right interpretation of a mantra and reliable data or they do more harm than contribute to the progress of knowledge.

The other estimates and arguments for the age of the Vedas are remarkable for their degree of ancientness. Many text books and web sites have summarized the subject of the age determination of the Vedas (e. g. Akhandjyoti). A summary of other estimates without detail is presented below.

Avinash Chandra Das in his famous book, "Rigvedic India" took a different route to assign an age to the RigVeda mantra (10/136/5). He used the correlation between the geological data of the Indian subcontinent and the geographic information in a mantra. Knowing the derived time of occurrence of specific geological change in the sub-continent, he concluded that the mantra has to be older than 27,000 years to 50,000 years.

This author looked at Avinash Chandra Das's suggested RigVeda mantra and found no indication that it related to any geological event. The *devata* (subject) of the 136$^{th}$ *sukta* is *Keshi* (the Sun) and the mention of two seas in the 5$^{th}$ mantra does not relate to a geological event. The mantra only addresses the Sun – "*The Sun that is desired by the senses of those with cognitive function and who befriend the air for respiratory function, illuminates both oceans- the ocean water on Earth and the ocean of space (Antariksh*)". On the basis of the geological description of the continent and the astronomy, other authors have given higher ages of the Vedas. Pawagi in his book entitled "Vedic Fathers of Geology" has estimated that the Vedas are about 240,000 years old. Pundit Dinanath Shastry in his book "Veda Kal Ka Nirnaya" (in Hindi) determined the age of the Vedas to be anterior to 300,000 years. Jwala Prasad's analytical research in "Rigvedic Geology and The Land of Saptsindhu" pushes the Vedic age to beyond 500,000 years BCE. The website quoted Jwala Prasad's comment on his own finding – "This is staggering but what is the escape", implying that facts are facts.

The 1911 Noble Laureate Professor Maeterlink (1862-1949), citing the evidential findings of German Archeologist Hellad, has argued in his book entitled "The Great Secret" that the Vedas are at least 7,000,000 years old. Swami Dayanand Saraswati, the founder of the "Arya Samaj", based on the Vedic Yuga-calendar calculations stated that the Vedas are as old as the Vedic calendar. Based on Swami Dayanand Saraswati's estimate this author calculated the age of the Vedas (age of the Srishti Calendar) in 2018 CE to be 1,972,949,119 years.

To conclude, even if the age-determination by different methodologies used by scholarly people is not scientific and decisive, what emerges is that the Vedas are far more ancient than the usual definition of ancientness and the Vedic references for this book are certainly beyond the milestone at February 18, 3102 BCE.

## Historical Records and Validation of Timeline-A

To understand a country's ancient history one has to depend on the archives of that country which can be in various forms, such as the country's literature, history books if they exist, coinage, stone inscriptions, discovered writings, historical objects and their carbon dating and so on. Without going into great details of what might be available in this realm for establishing the validity of the Timeline-A, let us examine the written

historical records. Extremely valuable historical data to validate Timeline-A has come from two sources, Swami Dayanand Sarasvati (1825-1883CE) and Acharya Udayaveer Shastri (1894-1991 CE). Before discussing the validation effort let us briefly look at the background of these two scholars par-excellence.

**Swami Dayanand Sarasvati**'s family gave him the name Mool Shankar. A few comments on Swami Dayanand Sarasvati have been included in the earlier text. A brief summary on his background will be of interest to some reader. Mool Shankar left home and took *sanyaas* (monk-hood) at the age of 22. After travelling and exploring the Himalayas and the forests of central India, the young yogi Mool Shankar reached Mathura with the desire to study the Vedas and other sacred books of the Vedic dharma under the tutelage of Swami Virjanand, a renowned Vedic scholar and an intellectual giant. The blind, 80-year-old, erudite yogi Virjanand had complete mastery over Vedic grammar and philology. Young Mool Shankar was fluent in Sanskrit and had learnt Vedas by heart before leaving home. The blind yogi Virjanand accepted Mool Shankar as his student. Under the direct tutelage of Virjanand, in ancient Vedic tradition, Mool Shankar developed deep knowledge of Ashtadhyayi grammar, Mahabhasya, Nighantu, Nirukt, Vedanta Sutra, Manusmriti and numerous other texts of Vedic Literature. After completing his studies, his guru Swami Virjanand bestowed upon him the *sanyaas*-name and blessed him to go out and preach the message of the Vedas to the society and re-establish the Vedic dharma. From there on Mool Shankar was known as Swami Dayanand Sarasvati.

Swami Dayanand Sarasvati was a great thinker and a philosopher of the recent times and a profound scholar of the Vedas, Darshans and the other books of Vedic Literature. A prolific writer in Sanskrit and Hindi this celibate monk translated the Vedas with commentary and interpretation. He was a superb orator. He traveled through North India imparting the Vedic message to the masses and participated in numerous public debates with the scholarly pundits. These formal debates called '*shaastraarth*' were the traditional forums in the Vedic society perpetuating from the ancient times for the benefit of the masses so that they may listen and understand the differences in the views of the scholarly. The *shaastraarths* kept alive the critical thinking in the society and therefore were a source of social reform. Swami Dayanand Sarasvati observed that the Hindu society had gone very far from the ancient Vedic practices and instead was following anti-Vedic rituals, blind beliefs, worshipping reincarnations of various gods in different forms and supporting social ills. He decided to tackle the ills of the society by preaching and writing rather than retreating to the Himalayas for meditation. He was the cause for the new thinking about the Vedas and the ancient books of the Aryans and he gave birth to much needed social reforms in the Hindu society of the time.

He preached with references of the Veda mantras and regenerated an environment of critical thinking. In the first half of his super eminent book in the Hindi language entitled "Satyarth Prakash" he presented a fresh view of what an Aryan society used to be like and ought to be. In the second half of the book, he critically examined the prevalent practices of Hindu religion and the other non-Hindu sects and faiths as well. A meaning of the title of the book of Satyarth Prakash is -- 'Illumination of the True Meaning'. It

was first published in 1881 CE and has 14 chapters in it. Reading the book of Satyarth Prakash, one perceives the emphasis on 'back to the Vedas' and one also gets a glimpse of the vastness of the ancient Vedic Literature that he read and has referred to in Satyarth Prakash. The contribution of this brilliant scholarly ascetic to Vedic Literature and to the social reforms in the Hindu society is immense. His knowledge of ancient Sanskrit Literature was deep. Just by beginning to read Satyarth Prakash one quickly gathers that Swami Dayanand had read a large number of ancient and rare books including ancient history books in Sanskrit Literature. The reference-rich writing is a fascinating feature of all the books that he wrote in a short period of time. In Satyarth Prakash alone he cited about 342 different ancient books from the Vedic Literature with about 1,450 different citations of mantras, *shlokas* and *sutras* that he interpreted and connected to the subject that he was dealing with.

**Acharya Udayaveer Shastri** was an Acharya in the true sense. The title of Acharya is bestowed on a person who has exhibited command on subjects like the Vedas and Shastras. He was a prolific writer. He wrote interpretive commentaries on all six Vedic Darshans and many more Vedic books including the history of the Vedanta Darshan. This author has benefitted immensely from his books written in the Hindi language. His research in Sanskrit Literature, adopted in this book, led to the establishing of the time-line in the Aryan history right up to the Mahabharata War that concluded with the coronation of King Yudhishthir in 3140 BCE.

In addition to the scholastic translation and interpretation of the Veda mantras and Darshan *sutras*, these two authors left behind a treasure-trove of historical information in their writings that has enriched this author's book in establishing the historicity of Vedic references.

First let us look at a part of the Indian history five centuries BCE.

## (1). 300-400 BCE: Megasthenes on Krishn, Validation of Time-milestone-4 on Timeline-A

The Indian history of the fourth century BCE is quite well known from Indian historical accounts. This is the period when Alexander the Great (356-323 BCE) invaded India. After Alexander crossed the Indus River and entered the Punjab region of ancient India, then called Paurava (now in Pakistan), he faced Raja Puru and his strong army in the epic battle of 326 BCE on the waters of River Jhelam (Hydaspes in Greek). King Puru and his army fought so fiercely against the invading Macedonians that Alexander, who was well-known to have left complete devastation behind him after each victory and who even killed those who surrendered - men, women and children, was highly impressed by the bravery of the Porus (citizens of Paurava). This fight was so fierce that even in victory, Alexander's army lost courage to advance further beyond the River Ganges. Alexander had no choice but to enter into an alliance with the King Puru and appointed Puru as the satrap of his own kingdom.

East of the Paurava Kingdom, across the River Ganges was the Magadh Kingdom (present region of Bihar and Bengal) which was ruled by the Nand Dynasty. Alexander's

army advanced as far as the River Beas and learnt in advance that on the other side of the River Ganga, about four miles wide and 200 yards deep, awaited two hundred thousand armed foot-soldiers, eighty thousand horsemen, eight thousand chariots, and six thousand fighting elephants. Alexander arriving at the shore of River Ganga ordered his army to cross the river. But seeing what awaited them on the other side, his army mutinied and Alexander the Great retreated and returned to Macedonia.

In 322 BCE Chandragupta Maurya overthrew the Nand Dynasty of Magadh, establishing the Maurya Empire with its kingdom at Pataliputra (present name Patna in Bihar State) that expanded well beyond Magadh. During the reign of Chandragupta Maurya his kingdom expanded in the Gangetic plains, westwards across central and western India on the heels of retreating Alexander the Great. He defeated all satraps that Alexander had left behind to rule on his behalf. By 316 BCE the Maurya Empire's rule extended from Assam in the east to Gaandhaar region in the west (present Kandahar in Afghanistan). It is the same Gaandhaar or Kandahar in Afghanistan that was ruled by King Subal around 3200 BCE who had married his daughter Gaandhaari to the blind King Dhritrashtra of Hastinapur (see Kuru- dynasty in Figure 3.2). In addition to the east-west expansion Chandragupta's rule had also extended from Himalayas in north to the south India. Historians credit Kautilya Chanakya (350-283 BCE) the brilliant prime minister, for Chandragupta Maurya's grand success in establishing such a big empire.

The well-known historical figure of the Indian history, Kautilya Chanakya, is credited for authoring the books of Arthshastra (Treatise on Economics) and Nithishastra (Treatise on Public Administration and Military). Chanakya is not a fictitious author and these books are not fiction. They are considered to be marvels of Chanakya's brilliance and are available for one to read. He was a professor at Takshashila (present distorted name is Taxila), one of the oldest universities and the seat of learning for Vedic and Buddhist philosophies and many other subjects. It functioned over 1,200 years starting from the 7$^{th}$ century BCE and lasted till 5$^{th}$ century CE. Taxila is situated 55 km from Islamabad, the capital of Pakistan and is a UNESCO World Heritage Site. After Alexander's invasion and ensuing disruption at Taxila, Chanakya moved to Pataliputra and helped establish the vast Maurya Empire of Chandragupta, the dynasty that was to last from 322 BCE to 185 BCE. This period of Indian history is very well-known from both, the Indian and Western historical perspectives and is a highly reliable base of historical facts. The literary work during this relatively recent historical past of the ancient Indian Civilization does not mention that the ancient books such as Manusmriti, Ramayana and Mahabharata were written around Chanakya's time.

After Alexander's death, Seleucus-I (Seleucus Nicator), a Greek general from Alexander's army invaded the kingdom of Chandragupta Maurya. Chandragupta defeated Seleucus. As part of the treaty Seleucus married off his daughter to Chandragupta and also handed over some of the territories under his rule. For goodwill, Seleucus dispatched an ambassador named Megasthenes (350 BCE - 290 BCE), to the court of Sandrocottus (Greek for Chandragupta). Megasthenes was born in Asia Minor, was a traveler, a geographer and a Greek historian who lived in India for two or three years and travelled to important cultural and religious centers of India. He wrote a

historically famous book titled “Indika”, wherein he recorded his observations on the social system, judiciary and religious practices in Indian society. Although the exact dates of Megasthenes’ embassy are not available the historians place Megasthenes’ period sometime close to 288 BCE, the year Chandragupta Maurya died.

Max Muller stated in his own book, ‘India - What Can it Teach Us?’ that in India according to Megasthenes’ account in Indika, *thefts were extremely rare and that they* (the people of India) *honored truth and virtue*. If this account of Megasthenes was credible then other accounts in Indika, even with his limited time and observation in India, have to be credible as well. While arbitrarily setting the age of Mahabharata and the Vedas, Max Muller certainly missed out Megasthenes’ account of the city of Mathura and Krishn, who was the ruler there, before he moved his capital to Dwarka in the present Gujarat State.

Dr. Satyavrat Siddhantalankar, in the introduction of his Hindi translation of Bhagvadgita (1965 ed.), has discussed the connection of Megasthenes and an important piece of ancient Indian history. The following discussion is based on his reference.

Megasthenes’ records in Indika describe a place called Methora and state that the people of this region worshipped Hiraiclese. The word analysis yields that just as Sandrocottus in Greek is Chandragupta in Sanskrit and the capital of the Emperor Chandragupta’s empire Palibothra in Greek is Pataliputra in Sanskrit, Methora in Greek is Mathura in Sanskrit and Hiraiklese in Greek is Shree Krishn in Sanskrit. The transition of the word from one language to the other could be viewed as –

Shree → Siri → Sirai →Hirai (sound of the letter s changing to the sound of h) and Krishn → Klese. Therefore in Greek endings of the names where ‘ese’ is the suffix, Shree Krishn becomes HiraiKlese. Obviously, Megasthenes is referring to Shree Krishn. The *shree* adjective in Sanskrit is equivalent to and similar sounding English term Sir. One immediate conclusion here is that the Greek historian Megasthenes is talking about a historical person Hiraiklese of Methora, who is none other than Shree Krishn. Therefore around 300 BCE according to Megasthenes’ account Lord Krishn was a real person - not a mythical figure. Important record in Megasthenes’ Indika is the approximate period of Hiraiklese that 138 generations had elapsed between Hiraiklese (Shree Krishn) and Sandrocottus (Chandragupta Maurya).

Counting of generations by Megasthenes, between Krishn and Chandragupta, should tell intellectuals, historians and the rest that Krishn of Bhagvadgita and Mahabharata was a real historical person up to the time of Megasthenes. Historians usually use 20 years for a generation. This gives an average total of 138x20 = 2760 years between Lord Krishn and the Emperor Chandragupta Maurya. As mentioned above, Chandragupta’s rule started in Pataliputra in 322 BCE. This takes us to Krishn’s period of 2,760 + 322 = 3,082 BCE.

According to Sanskrit Literature, Shree Krishn died very close to the onset of Kali Yuga in 3102 BCE, the time-milestone Marker-5 on the Timeline-A. The two numbers, 3102 BCE and 3,082 with Megasthenes’ account therefore are remarkably close. Megasthenes’ records therefore help debunk unsound hypotheses of some Indologists.

Krishn was an Arya of the ancient Aryan Civilization of India. Therefore, Megasthenes also puts a nail in AIT's coffin.

## (2). The Case of Rajtarangini – A Book of Ancient History

About a millennium old book Rajtarangini (Raj-Tarangini), in Sanskrit, authored by Kalhan in 1148 CE, gives the genealogy and other historical description about the Kashmiri rulers. Based on the history in Rajtarangini, Acharya Udayaveer Shastri in his book "Vedanta Darshan Ka Itihas" (History of Vedanta Darshan, 1991) has offered valuable details and discussion. Based on Acharya Udayaveer Shastri's discussion on Rajtarangini's genealogy of the Kashmir kings, this author provides an analysis that takes the reader 5,000 years in the past. This author has supplemented the historical information given in Rajtarangini with the independent historical events recorded in the book of Mahabharata when Shree Krishn, Yudhishthir and Arjun were active historical personalities. To establish the context a limited historical account of Rajtarangini is presented below.

The first king in Rajtarangini's Kashmir dynasty is King Gonand. King Gonand according to Rajtarangini was present during the Mahabharata period. The Magadh Kingdom (present state of Bihar and Bengal together) at that time was ruled by King Jarasandh, an extremely ambitious and cruel king. King Gonand of Kashmir colluded with King Jarasandh and together they attacked Mathura from where Shree Krishn ruled. Let us tie the history of 3100 BCE together with that of the account in Megasthenes' book Indika presented above. It is the same Magadh kingdom of Jarasandh, ruled later in the 4th century BCE by King Nand when Alexander retreated from attacking the Magadh region. It is the same region which Chandragupta Maurya (Sandrocottus in Greek) took over from Nand in 322 BCE. Mathura is the same as Methora in Megasthenes' account in Indika where Shree Krishn ruled from. Shree Krishn is Megasthenes' HiraiKlese.

In the war imposed by King Gonand of Kashmir and King Jarasandh of Magadh on King Krishn of Mathura, King Gonand was killed by Krishn's step-brother Balram. Gonand's son Damodar was enthroned as the king of Kashmir but was revengeful towards Krishn for his father's death. During this period the Gaandhaar-royalty, which also was the maternal dynasty of the Kauravas of Hastinapur, hosted a *svayamvar* for the princess of Gaandhaar; *svayamvar* is the process of 'self-selection' of a life-partner by an unmarried girl from among the invited guest hopefuls. Among the many invitees was a prospective king named Vrishni. To add prestige to his presence in the gathering for the *svayamvar* at Gaandhaar, King Vrishni invited Krishn to accompany him to Gaandhaar. The young king Damodar of Kashmir came to know about Krishn traveling to Gaandhaar. He saw it as the opportunity to avenge his father Gonand's death. When King Vrishni's entourage, with Krishn accompanying him, reached the border of Kashmir, King Damodar attacked the entourage of Vrishni and Krishn. The young Damodar was killed by Krishn himself. Krishn, anticipating the ensuing disorder in a ruler-less Kashmir society, placed Damodar's pregnant young queen Yashomati on the Kashmir throne. She gave birth to a son who was named Gonand Dvitiya (Gonand II) after his grandfather.

According to Rajtarangini's description covered in 26 shloka couplets of its first chapter (1/57-82), Gonand II was the 4th king of Kashmir (after Gonand, Damodar and queen Yashomati). At that time the Mahabharata War loomed on the horizon and it polarized the kingdoms of India as they were forced to take sides. Kalhan, the author of Rajtarangini, writes that Gonand II being a child was not invited to take part in the great war of Mahabharata. Kalhan also writes (Rajtarangini, 1/83) that because all reliable references on the kings of Kashmir after Gonand II were destroyed, he had no information available on the next 35 kings of Kashmir to include in Rajtarangini. After acknowledging this gap in the genealogy of Kashmir kings the historian Kalhan lists the King Kush to be the 41st and continues on till Gonand III as the 55th king of Kashmir. Kalhan in Rajtarangini has given the description of 86 additional kings from king Gonand III up till the time of the writing of Rajtarangini in 1148 CE. Therefore from the first king Gonand up till Kalhan's writing of Rajtarangini, there have been 55+86 =141 kings in Kashmir.

No matter what logic one uses, one cannot brand Kalhan's Rajtarangini a fictitious book of history. Rajtarangini is a book of history of the kings of Kashmir. Kalhan has accounted for 141 kings of Kashmir up till 1148 CE. His description takes us to a point in history that is as real as reality. Mahabharata, the reality emerging out of Rajtarangini is to be faced by skeptic historians. To top it off Kalhan in his book relates Gonand, the first king of Kashmir and his son and grandson to persons, places and events – King Jarasandh, Magadh, Kashmir, Gaandhaar and the Mahabharata War. All this cannot be fictitious or mythological because Rajtarangini by Kalhan is a book of history accepted by historians as such. The independent historical account of Kashmir King Gonand inviting King Jarasandh of Magadh to takeover Krishn's Mathura ties in well with the historical account of Jarasandh.

The norm of the ancient kings of the Aryavart society had been that if a king was defeated by another king, the defeated king was to accept the rule of the winner. However, it was considered *a-dharmik* (*non-dharmic* = immoral) to kill women, children, farmers and Brahmins (knowledge givers and teachers) and it was *a-dharmik* to kill those who surrendered in battle. All kings who swore allegiance to an emperor were generally allowed to carry on as rulers of their respective kingdoms. The emperor, after defeating a king, would enthrone the heir-apparent of the same kingdom. An example was cited above from the Rajtarangini where Krishn, instead of grabbing the Kashmir kingdom for himself had instead enthroned the widowed queen.

Non-*dharmik* king, Jarasandh on the contrary attacked a large number of small kings in and around Magadh region, took over their kingdoms and took the defeated kings as prisoners in spite of their surrendering to him. Whereas the 1148 CE book Rajtarangini, written by Kalhan in Kashmir independently relates the activities of the cruel king Jarasandh along with the Kashmir king Gonand and their collusion against Krishn, the 3140 BCE book of Mahabharata gives considerable number of corroborative details about Jarasandh. His father's name was King Brihadrath and his son was Prince Sahadev. To declare his emperorship over a large region, Jarasandh had captured 86 kings and targeted to capture 14 more to consolidate his kingdom. The description states that all captured kings were kept in filthy prisons and his plan after capturing the

remaining kings was to kill them all. Such a ruler who flagrantly disobeyed rules of dharma in the society was to be eliminated. Without going into the details of this part of the ancient history it should suffice here that Krishn, Arjun and Arjun's warrior brother Bhim were sent by Yudhishthir to wipe out Jarasandh. Bhim killed Jarasandh and Krishn freed all the imprisoned kings who were perishing in Jarasandh's prisons. Krishn consoled the Prince Sahadev for his father's death and enthroned him to rule Magadh. The historical information of this period is corroborated well by two independent sources of recorded history, the book of Mahabharata around 3140 BCE and the Rajtarangini written in 1140 CE.

This section is concluded with a bit of math on Kalhan's data. The period, between Mahabharata War ending in 3140 BCE, as on milestone Marker-4 on the Timeline-A of Figure 3.1 and the undisputed year of 1148 CE for Kalhan's book Rajtarangini, yields time period of 4,288 years. The number of kings in Kashmir genealogy according to Kalhan is 141. This gives an average of about 30 years per king. Historians' thumb rule for averages for determining historical periods extending over 4,000 years should accept this average also. Therefore, the Mahabharata War between Kauravas and Pandavas, with Krishn as the charioteer of Arjun, and the other personalities mentioned in the book of Mahabharata are a proven part of the history at milestone Marker-4 on the Timeline-A in Figure 3.1.

## (3). Ancient History from the Book of Satyarth Prakash

The remarkable book entitled "Satyarth Prakash", written by Swami Dayanand Sarasvati (1825-1883), was first published in 1881 CE in the Hindi Language. By the time Swami Dayanand wrote Satyarth Prakash, he had read a large number of ancient and rare books of Sanskrit Literature. Although his emphasis in Satyarth Prakash was not the history of the Vedic period or the history of the Indian culture and Civilization, one can still glean from his book considerable information on ancient Indian history. Throughout Satyarth Prakash and in particular towards the end of its $11^{th}$ out of 14 chapters, it becomes obvious that this brilliant monk had even read ancient history books in Sanskrit Literature. Can there be a more reliable account of the history of a country than the historical records in the ancient indigenous literature of that country? No. Therefore one can reasonably put time-markers on a timeline running into the distant past of Vedic culture and history based on the historical information gleaned from Satyarth Prakash. For the sake of brevity the Timeline-A in Figure 3.1 has only a few time-markers, however, based on Satyarth Prakash one could populate the Timeline-A with many more important historical events and persons from the ancient Aryan history. Satyarth Prakash not only deals with the Vedas and Vedic philosophy but also critically examines the literary pollution created by some of the Indian pundits on the one hand and some of the Western Indologists and Sanskritists on the other hand that led to the erroneous Timeline–B of Figure 3.1. Satyarth Prakash provides strong evidence in support of several markers on the Timeline-A and takes us step by step to 3140 BCE lending yet another positive proof of the Reference Hypothesis (***"The basic Vedic references on cosmology are ancient and precede a 5,000 year period"***).

Recall that the time Milestone-6 and 7 on the Timeline-A relate respectively to Aadi Shankaracharya, the propagator of *Adwaita-Vedanta* philosophy and King Vikramaditya of Avantika (Ujjain). Swami Dayanand Sarasvati in the 11th chapter of Satyarth Prakash gives considerable historical information about young Shankaracharya's contribution to the then ongoing debate on theism with the scholars of atheistic Buddhism and Jainism sects, including the fact that Jain opponents revengefully had poisoned Shankaracharya. Swami Dayanand writes that Shankaracharya lived about 2,200 years ago (as of 1880 CE) which is about 320 BCE. He also stated that a highly renowned king named Vikramaditya ruled from the city of Avantika (Ujjain) in Madhya Pradesh about 300 years after Shankaracharya. Swami Dayanand writes that the King Vikramaditya brought together warring kings and established peace in Aryavart. This Vikramaditya is the same king after whom the Vikram Era calendar started in 57 BCE that was discussed earlier. Vikramaditya is also known as a great king for his justice system and for his long life and rule.

Whereas the numbers of years mentioned in Satyarth Prakash are approximate round numbers, Swami Dayanand places Shankaracharya several centuries before Vikramaditya. This validates the historic order of Markers 6 and 7 on the Timeline-A. Based on the written records from Shankaracharya Mathas (monasteries) it is shown in the next section that Shankaracharya died in 477 BCE. One would therefore notice a discrepancy of about (477-320) 157 years between Swami Dayanand's surmise and Matha records on Shankaracharya. This discrepancy of about 157 years is in a historical account of 2,357 years before Swami Dayanand. To understand this discrepancy two points are to be kept in mind: Swami Dayanand Sarasvati used round figures for Shankaracharya's period with the main focus in that section of Satyarth Prakash was the *Adwaita-Vedanta* philosophy and not the settling of historical details of that period. According to Satyarth Prakash, Shankaracharya precedes at least about 320 years BCE. On the other hand the Western Indologists and a large number of their Indian followers have placed the Time-milestone-6 after 0 CE at 788 CE as shown on Timeline-B in Figure 3.1 creating a discrepancy of about 1,300 years. This artificially created myth certainly needs scrutiny. In the section on Shankaracharya, presented below, it is proven without a doubt that the Marker-6 for Shankaracharya on the Timeline-A in Figure 3.1 is where it is supposed to be, before the Marker-7 for the King Vikramaditya. For now the conclusion is that Swami Dayanand Sarasvati's fleeting reference of the period of Shankaracharya counteracts those who shorten the age of Indian history by 1300 years.

## Genealogy of Delhi Kings on Timeline-A

Swami Dayanand Sarasvati, at the end of the 11th chapter of Satyarth Prakash, has provided records of the successive dynastic rule of the Aryan kings who ruled from Delhi starting from the Emperor Yudhishthir (3140 BCE) till the king Prithvi Raj Chauhan (1192 CE) when he was dethroned by the Muslim invader exterior to India. Swami Dayanand's records are from a history book written in 1725 CE that validate the markers on the Timeline-A. In Satyarth Prakash, Swami Dayanand provides full reference for the

source of this historical information. Translated from Hindi to English by this author, Swami Dayanand states:

> *"...I have translated this material from the fortnightly publication from Nathdwara, Harishchandrika and Mohanchandrika, which are well-known in the kingdom of Udaipur Chittor Fort in the Mewar region of Rajputana. It will greatly benefit the country if the members of the Aryan society likewise researched the historical books and books of knowledge and published them. The respected editor* (of Harishchandrika and Mohanchandrika) *received an ancient book from his friend, which was written in Vikram Era 1782 (seventeen hundred eighty two) and published in the issues 19 and 20 of his two publications dated Maargsheersh, bright-lunar phase of Samvat 1939* (Vikram Era). *"*

In the above quotation the history book that provides the genealogy of the Delhi kings was written in 1782 VE (Vikram Era) which is 1725 CE). The lunar calendar date of publication issues 19 and 20 of the fortnightly is in the month of Margsheersh in the year 1939 VE which corresponds to October-November in 1882 CE. This author has reproduced below the genealogy of the Delhi kings in Table 3.3 as it is in Satyarth Prakash. This table is made up of sub-tables that represent transition of genealogy from one Aryan rule to another Aryan rule. In this table are interspersed historical notes by Swami Dayanand that he took down from the original publication. These notes primarily relate to the cause for the change of genealogy. These notes are original to the history book written in 1725 CE. A discussion on the writing process in ancient India is in Chapter 4. The writing with the black ink was carried out on several mediums such as the *bhoj-patra* (thin bark of birch tree), paper made of cotton or silk. The records and manuscripts were rewritten when they faded or got damaged. The history book from which the data came to Swami Dayanand must have been also rewritten several times over a time period over 4,000 years starting from Emperor Yudhishthir. Therefore the historical notes at the transition of dynasties and some anecdotal information about certain kings must have been copied by the successive writers, spanning over centuries. The overall impression therefore is that the *raj-purohits* (royal-priests), responsible for recording history for the kings, have recorded it with the intension of preserving the historical events. To test its authenticity this table is examined from several perspectives and some discrepancies with possible explanations are pointed out. The historical comments of the history book are in italicized quotes.

> "*At Indraprasth (Delhi) from emperor Yudhishthir to Yashpal have been 124 (one hundred twenty-four) kings who ruled over 4,157 years, 9 months and 14 days. They are presented here. There were 30 rulers in Yudhishthir genealogy who ruled for 1,770 years 11 months and 10 days. Their details are"*:

**Table 3.3:** Genealogy of Aryan kings of Indraprasth (Delhi). Number of years (Y), months (M) and days (D) for the rule of each king are shown in the last three columns.

| No. | King | Y | M | D | No. | King | Y | M | D |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Yudhishthir | 36 | 8 | 25 | 16 | Suchiratha | 42 | 11 | 2 |
| 2 | Parikshith | 60 | 0 | 0 | 17 | Shoor Sen II | 58 | 10 | 8 |
| 3 | Janmejaya | 84 | 7 | 23 | 18 | Parvata Sen | 55 | 8 | 10 |
| 4 | Ashwamedha | 82 | 8 | 22 | 19 | Medhavi | 52 | 10 | 10 |
| 5 | Rama II | 88 | 2 | 8 | 20 | Sonacheera | 50 | 8 | 21 |
| 6 | Khatra Mal | 81 | 11 | 27 | 21 | Bhima Deva | 47 | 9 | 20 |
| 7 | Chitta Ratha | 75 | 3 | 18 | 22 | Nrihari Deva | 45 | 11 | 23 |
| 8 | Dashta Shailya | 75 | 10 | 24 | 23 | Poorna Mal | 44 | 8 | 7 |
| 9 | Ugra Sen | 78 | 7 | 21 | 24 | Kardavi | 44 | 10 | 8 |
| 10 | Shoor Sen | 78 | 7 | 21 | 25 | Alamika | 50 | 11 | 8 |
| 11 | Bhuvanpati | 69 | 5 | 5 | 26 | Udaya Pal | 38 | 9 | 0 |
| 12 | Rana Jita | 65 | 10 | 4 | 27 | Durvana Mal | 40 | 10 | 26 |
| 13 | Rikshaka | 65 | 7 | 4 | 28 | Damata | 32 | 0 | 0 |
| 14 | Sukhadeva | 62 | 0 | 24 | 29 | Bhima Pal | 58 | 5 | 8 |
| 15 | Naraharideva | 51 | 10 | 2 | 30 | Khemaka | 46 | 11 | 21 |

**Historical note:** '*King Khemaka was murdered by his prime-minister Vishrava whose 14 generations ruled for 500 years 3 months and 17 days, they are as following'*.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 31 | Vishrava | 17 | 3 | 29 | 38 | Kadruta | 42 | 9 | 2 |
| 32 | Pura Seni | 42 | 8 | 21 | 39 | Sajja | 32 | 2 | 14 |
| 33 | Veera Sen | 52 | 10 | 7 | 40 | Amar Chud | 27 | 3 | 16 |
| 34 | Anang Shayi | 47 | 8 | 23 | 41 | Amipal | 22 | 11 | 25 |
| 35 | Hai jit | 35 | 9 | 17 | 42 | Dasharatha | 25 | 4 | 12 |
| 36 | Param Seni | 44 | 2 | 23 | 43 | Veera Sala | 31 | 8 | 11 |
| 37 | Sukhpatala | 30 | 2 | 21 | 44 | Veerasal Sen | 47 | 0 | 14 |

**Historical note:** '*King Veerasal Sen's prime-minister Veer Maha murdered him and became the king whose 16 generations ruled for 445 years 5 months and 3 days, they are as following'*.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 45 | Veer Maha | 35 | 10 | 8 | 53 | Tej Pal | 28 | 11 | 10 |
| 46 | Ajit Sinha | 27 | 7 | 29 | 54 | Manik Chand | 37 | 7 | 21 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 47 | Sarva Datta | 28 | 3 | 10 | 55 | Kama Seni | 42 | 5 | 10 |
| 48 | Bhuvanpati | 15 | 4 | 10 | 56 | Shatru Mardan | 8 | 11 | 13 |
| 49 | Veera Sen | 21 | 2 | 13 | 57 | Jeevan Loka | 28 | 9 | 17 |
| 50 | Mahipal | 40 | 8 | 7 | 58 | Hari Rao | 26 | 10 | 29 |
| 51 | Shatru Shala | 23 | 4 | 3 | 59 | Vira Sen II | 35 | 2 | 20 |
| 52 | Sangha Raja | 17 | 2 | 10 | 60 | Aditya Ketu | 23 | 11 | 13 |

**Historical note:** '*Aditya Ketu was killed by the King Dhandhar of Prayag whose dynasty had 9 rulers ruling for 374 years 11 months 26 days. They are as following'.*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 61 | Dhandhar | 42 | 7 | 24 | 66 | Jeevan Raj | 45 | 2 | 5 |
| 62 | Marshi | 41 | 2 | 29 | 67 | Rudra Sen | 47 | 4 | 28 |
| 63 | Sanarach | 50 | 10 | 19 | 68 | Aarilak | 52 | 10 | 8 |
| 64 | Mahagadha | 30 | 3 | 8 | 69 | Rajpal | 36 | 0 | 0 |
| 65 | Duranatha | 28 | 5 | 28 | | | | | |

**Historical note:** '*King Rajpal was overthrown and killed by his General Mahanpal who ruled for 14 years 0 months 0 days. No more details about his rule*'.

70 Mahanpal 14 0 0

**Historical note:** '*King Mahanpal was attacked and killed by King Vikramaditya of Avantika* (Ujjain) *who ruled from Avantika for 93 years 0 months 0 days. No more details about his rule*'.

71 Vikramaditya 93 0 0

**Historical note:** '*King Vikramaditya was attacked and killed by King Shalivahan's noble Samudra Pal Yogi hailing from Paithan and who established rule* (over Indraprasth) *for 16 generations ruling 372 years 4 months and 27 days. They are listed in the following'.*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 72 | Samudra Pal | 54 | 2 | 20 | 80 | Amrit Pal | 36 | 10 | 13 |
| 73 | Chandra lPal | 36 | 5 | 4 | 81 | Bali Pal | 12 | 5 | 27 |
| 74 | Sahoy Pal | 11 | 4 | 11 | 82 | Mahi Pal | 13 | 8 | 4 |
| 75 | Dev Pal | 27 | 1 | 28 | 83 | Hari Pal | 14 | 8 | 4 |
| 76 | Narsingh Pal | 18 | 0 | 20 | 84* | Sees Pal | 11 | 10 | 13 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 77 | Sam Pal | 27 | 1 | 17 | 85 | Mahan Pal | 17 | 10 | 19 |
| 78 | Raghu Pal | 22 | 3 | 25 | 86 | Karam Pal | 16 | 2 | 2 |
| 79 | Gobind Pal | 27 | 1 | 17 | 87 | Vikram Pal | 24 | 11 | 14 |

**Historical note** on item 84: '* *also Bhim Pal* i*n some history books*.'

**Historical note:** '*King Vikram Pal of Indraprasth attacked Malukhchandra Vohara, the king of the Western India but was slain in a pitched battle in an open battle-field. Malukhchandra became the king of Indraprasth. His dynasty had 10 kings ruling for 191 years 1 month 16 days. They are listed in the following'*.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 88 | Malukh Chandra | 54 | 2 | 10 | 93 | Kalyan Chand | 10 | 5 | 4 |
| 89 | Vikram Chand | 2 | 7 | 12 | 94 | Bhim Chand | 16 | 2 | 9 |
| 90* | Amin Chandr | 10 | 0 | 3 | 95 | Lov Chand | 26 | 3 | 22 |
| 91 | Ram Chand | 13 | 11 | 8 | 96 | Govind Chand | 31 | 7 | 12 |
| 92 | Hari Chand | 14 | 9 | 24 | 97** | Queen Padmavati | 1 | 0 | 0 |

**Historical note on item 90*:** '*His name elsewhere is also written as Manak chand.'*Item 97**: '*The Queen Padmavati was Govind Chand's Queen. She died heirless. Her nobles took a decision to put Hari Prem Vairagi on the throne and ruled themselves. His dynasty had 4 kings whose reign lasted for 50 years 0 months 21 days. Those details are' -*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 98 | Hari Prem | 7 | 5 | 16 | 100 | Gopal prem | 15 | 7 | 28 |
| 99 | Gobind Prem | 20 | 2 | 8 | 101 | Mahavahu | 6 | 8 | 29 |

**Historical Note:** '*King Mahavahu renounced the throne, became a recluse and proceeded to the forest for meditation and self-realization. On hearing this, Adhi Sen the King of Bangal took over the throne of Indraprasth. His dynasty had 12 kings ruling for 151 years 11 months 2 days. His details are*.'

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 102 | Adhi Sen | 18 | 5 | 21 | 108 | Kalyan Sen | 4 | 8 | 21 |
| 103 | Vilaval Sen | 12 | 4 | 2 | 109 | Hari Sen | 12 | 0 | 25 |
| 104 | Keshav Sen | 15 | 7 | 12 | 110 | Khem Sen | 8 | 11 | 15 |
| 105 | Madhav Sen | 12 | 4 | 2 | 111 | Narayan Sen | 2 | 2 | 29 |
| 106 | Mayur Sen | 20 | 11 | 27 | 112 | Lakshmi Sen | 26 | 10 | 0 |
| 107 | Bhim Sen | 5 | 10 | 9 | 113 | Damodar Sen | 11 | 5 | 19 |

**Historical Note:** '*King Damodar Sen was very oppressive to his nobles. One of his nobles, Deep Singh won over the king's army and fought the king. The king was killed and was succeeded by Deep Singh whose dynasty had 6 kings ruling for 107 years 6 months 22 days. Their details are'-*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 114 | Deep Singh | 17 | 1 | 26 | 117 | Nar Singh | 45 | 0 | 15 |
| 115 | Raj Singh | 14 | 5 | 0 | 118 | Hari Singh | 13 | 2 | 29 |
| 116 | Ram Singh | 9 | 8 | 11 | 119 | Jivan Singh | 8 | 0 | 1 |

**Historical Note: '*For some reason King Jivan Singh sent all his army to the north. On hearing this, Prithvi Raj Chauhan, King of Virat, attacked King Jivan Singh who fell in the battle and Prithvi Raj Chauhan became the King at Indraprasth who had 5 kings in his dynasty ruling for 86 years 0 months 20 days. They are described below'-***

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 120 | Prithvi Raj | 12 | 2 | 19 | 123 | Uday Pal | 11 | 7 | 3 |
| 121 | Abhaya Pal | 14 | 5 | 17 | 124 | Yash Pal | 36 | 4 | 27 |
| 122 | Durjan Pal | 11 | 4 | 14 | | | | | |

Swami Dayanand Sarasvati casts doubt on the last dynasty of Aryan kings (items 121 to 124) at Delhi and suggested to follow present historians, according to which the last Aryan King at Delhi was Prithvi Raj who ruled till 1249 Vikram Era (1192 CE) after which the Muslim rule began at Delhi.

Let us now analyze the data that Swami Dayanand Sarasvati presented from the old history book in Sanskrit. In spite of the apparent discrepancies of minor nature in the Table 3.3 the value of the data leads to the fact that these data render a positive proof of the Timeline-A and the historical markers on it.

## Analysis of Indraprasth (Delhi) Genealogies

Assuming that the Aryan dynasties ended with Prithvi Raj Chauhan in 1192 CE, the sum total of Aryan rule from Yudhishthir to Prithvi Raj according to Satyarth Prakash data is 4,069 years, 11 months and 3 days, a period ruled by 120 Aryan kings. Rounding off this period between Yudhishthir and Prithvi Raj Chauhan gives 4,070 years. Added to it the period between 1192 CE and 2018 CE (826 years) gives 4,996 years; about five thousand years back in history.

An important correction is needed in this estimate of 4,070 years. The month in the Table 3.3 is assumed as a 30-day period. In a luni-solar Aryan calendar the 5 days are adjusted to keep all festivals synchronized, the month is counted as a 30-day period. Therefore 5 days a year remain unaccounted for in the Table 3.3. This results into a correction of 56.5 days in

4,070 years. With this correction the total period between Yudhishthir and Prithvi Raj is: 4,070 +56.5 = 4,126.5 = 4,127 years.

It is also obvious from the data of the Table 3.3 that a 30-day month has been used throughout the tables. Even though Yudhishthir ruled for 36 years 8 months and 25 days and renounced the throne to go to the Himalayas for meditation and self-realization, about half a dozen kings in his genealogy after him ruled on an average of about 80 years per king and the next half a dozen kings ruled an average of 70 years each. At the same time, a sudden change in rule by a change in the dynasty reduces the average period of rule by a king in the Delhi dynasties between Yudhishthir and Prithvi Raj Chauhan. The average ruling period in Delhi dynasty is about 4070/120 = 34 years. This is quite close to the 30.4 years estimated from the independent historical records for the stable Kashmir dynasty recorded in Rajtarangini the book written by Kalhan in 1148 CE; both rules running parallel in time at different locales.

These average ruling periods, derived from the years of rule and the number of kings in two different dynasties, are available from two independent history books written in two different locales at two different times. The history book cited by Swami Dayanand in Satyarth Prakash was written in 1725 CE for the Delhi rulers and the book of Rajtarangini discussed in the previous section was written by Kalhan in 1148 CE; two books written over half a millennium apart substantiate the historical fact that Mahabharata War, Yudhishthir, Krishn and other personalities were present near 3140 BCE

Megasthenes' records in Indika cited above had suggested 138 generations to Lord Krishn and not the actual number of kings. Counting generations and counting actual number of kings who ruled are two different things. For example the Queen Elizabeth II of England, coronated at the age of 25, has seen four generations during her single rule over 60 years by the year 2018 CE. The 138 generations between Hiraiklese (Shree Krishn) and Sandrocottus (Chandragupta Maurya) proportionately look much higher than both accounts, in Satyarth Prakash and in Rajtarangini. The difference is that the counts of these books provide years of rule by an actual king regardless of how many generations that a king ruled. The historians' average for the age of a generation is naturally much less than the average rule by the kings at Delhi or at Kashmir. Both approaches do lead to valuable historical information. While Megasthenes' generation count can lead to the approximate period in history, the data as in the Table 3.3 bring one closest to reality. It is therefore obvious that two history books provide more accurate historical information. Recording of years, months and days of rule by a king is as accurate as one can get. The count for Delhi dynasties based on year, month and day for the rule of each king is indeed most accurate of all.

The date for the start of Kali Yuga on February 18, 3102 BCE is accepted by most historians of Vedic tradition and some astronomers as well. If there is any disagreement on this, it is within a day or two because some scholars have considered the onset of Kali Yuga on February 20, 3102 BCE instead. However, the time elapsed from 3102 BCE at the onset of Kali Yuga to the last Aryan king at Delhi, Prithvi Raj Chauhan is: 3,102+1,192 = 4,294 years. This in terms of Kali Yuga Era is 4294 KE at Prithvi Raj Chauhan. The number of years estimated from the Table 3.3 between Yudhishthir and Prithvi Raj with correction is 4,127 years. The difference between the two calendar numbers (YE and KE) is therefore 4294 KE – 4127 YE = 167 years, KE starting before YE. This is not acceptable to the Indian historians of Vedic tradition because the difference between Yudhishthir's coronation (onset of Yudhishthir Era) and the onset of KE is 38 years after Yudhishthir. Therefore there is a discrepancy of 167+38 = 205 years. As mentioned before, the KE being the calendar based on astronomy has

minimum error and is practically independent of human interference. This discrepancy could be attributed to the records in the history book which put Yudhishthir about 200 years after the onset of KE. Therefore the data of the table underestimates the total period of Aryan kings by about 200 years in about 4127 year-long period causing a deviation of about 4.5%.

The average rule by a king in Delhi dynasties being 34 years, this discrepancy is equal to about 3 to 4 rulers missed out in the history records of Table 3.3. To determine whether the Vikramaditya who ruled Delhi from Ujjain, included in the Delhi genealogy as 71st entry is one and the same king, the years from Yudhishthir to the beginning of Vikram Era (excluding the 71st entry) were estimated. This estimate is about 3,102 years. The estimate between KE onset in 3102 CE and 57 BCE is 3,045 years. Therefore the difference between the YE and KE is 3,102 - 3,045 = 57 years. Because the difference between YE and KE is exact 38 years the discrepancy is only 19 years over 3,000 years, which is about half a percent. Therefore, the King Vikramaditya is one and the same person. Also, most of the discrepancy in the history tables of 3 to 4 rulers is in the last one thousand years of the table. Over a period of five thousand years this is quite understandable. Considering that such a consistent and detailed data were even available, representing a five thousand year non-religious history, found somewhere in the world, by itself is remarkable.

The likely cause for such a discrepancy, small though it may be, could be in the process of recording history with the possibility of human error in the writing and rewriting the same records after long gaps to refresh the writing medium, the bhoj-patra or silk cloth. Nevertheless the listing of kings that Swami Dayanand included in his book Satyarth Prakash is from a book of history as opposed to the baseless contention of Max Muller that Indians did not write history. The nature of historical notes in between the change of dynasty tells us that the 1782 VE (1725 CE) book in Sanskrit is a credible history book.

One historical fact which becomes clear from the Table 3.3 is that the king at Serial No. 71 is Vikramaditya. Although Vikramaditya ruled from Ujjain, most kings of North India during his rule had accepted his emperorship including the ones at Delhi. Therefore the ancient historians must have credited him for the rule at Delhi as well and included him in the genealogy list of Delhi. This is obvious from the lone entry at the 71st row. When the years are added up the addition brings us to a period coincident with the rule of Vikramaditya of Ujjain in Central India. This Vikramaditya is the same long-lived, brilliant king known for his valor and justice. It is the same Vikramaditya of Ujjain in whose praise the Vikram Calendar of the Hindus (Table 3.2) was started in 57 BCE. He is known to have sent Sanskrit scholars and mathematicians to Middle East on request by the rulers there. Towards the end of his life King Shalivahan became powerful who sent his General Samudra Pal to overthrow Vikramaditya. King Shalivahan ruled from Avantika after Vikramaditya, over all regions including Indraprasth (Delhi). The dynasty at Indraprasth began with the rule of Shalivahan's general Samudra Pal; listed as the 72nd Aryan king under the Delhi dynasties in the Table 3.3. Twenty two years after Vikramaditya's death began another Hindu Calendar in King Shalivahan's name. Both calendars are still running in parallel; Shalivahan Calendar being more popular in South India.

The Table 3.3 has a few other discrepancies of editorial nature that if corrected would eliminate the difference between KE and YE. Thus the data in Table 3.3 ties several loose-ends and supports the Timeline-A.

The Reference Hypothesis has been already proven above in several different ways and now we present in the following section the final proof from the recorded history at

Shankaracharya monasteries which is available for one to access at the present time. These records at the monasteries provide the connection between the YE, KE, VE and CE calendars telling us that the Vedic references are older than 5,000 years.

## (4). Aadi Shankaracharya at Milestone-6 on Timeline-A

Aadi Shankaracharya and his monasteries were referred to in Chapter 1. This section presents very valuable written historical material related to Shankaracharya that proves the position of the time Marker-6 on the Timeline-A (Figure 3.1). At the same time it provides a proof for the position of the time Markers-4 and 5. This material also sets the ancient Indian historical record straight. Historical data and facts have been brought out by the great Sanskrit scholar and philosopher, the late Acharya Udayaveer Shastri (1894-1991CE), from his arduous research in ancient literature, particularly the literature preserved at Shankaracharya Mathas (monasteries). Acharya Udayaveer Shastri and his remarkable book "**Vedanta Darshan Ka Itihas**" (History of Vedanta Darshan) in Hindi language published in 1991 just before his death at the age of 97 have been the inspiration for this author to present these undisputable historical facts. The book's acronym, VDKI will be used in the following text. In VDKI he tied historical loose ends starting from the time of Rishi Vedvyas at the Marker-4 to the milestone at Aadi Shankaracharya at the Marker-6 on this author's Timeline-A, a period over three thousand years of Vedic History. To achieve this incredible feat he researched the literature well-guarded and preserved at Shankaracharya Mathas that Aadi Shankar himself established in the fifth century BCE. Acharya Udayaveer Shastri brings the reader slowly and carefully with cross-check of references from Aadi Shankaracharya up until contemporaneous care-taker *acharyas* of the Mathas. The Mathas are functioning well even to this day at the same locations where Aadi Shankaracharya had originally established them between 499 BCE to 482 BCE in different parts of India.

Acharya Udayaveer Shastri was a Sanskrit scholar, a great thinker, a Vedic philosopher with deep knowledge of Vedic literature. He was also a Vedic historian, a prolific Hindi writer with about a dozen books to his credit. He authored in Hindi language the interpretive translations of all six Vedic Darshans (Sutras). He was bestowed with high literary honors and titles like, Vidyabhaskar, Ved-Ratna, Nyaya-Vaisheshik-Sankhya-Yog Teerth, Vedantacharya and Shastrashevidhi. Acharya Udayaveer Shastri, having direct access to protected historical records at the present Shankaracharya Mathas uncovered valuable material that he included in his book VDKI. With his persistent effort and research in Sanskrit Literature at Shankaracharya Mathas, he brought out the historical facts that clear the fuzz of fog hovering over Aryan history of the past 5,000 years.

This author has greatly benefited from the knowledge-pool contained in Acharya Udayaveer Shastri's books on all six Vedic Darshans and his interpretation of *sutras* and Veda mantras. This author gratefully acknowledges the historical data given in VDKI that has been used here and analyzed to establish the validity of the Timeline-A in Figure 3.1 and all the time markers on it, thus validating the Reference Hypothesis that all references on Vedic Cosmology Principle used in this book predate 5,000 years, well before the beginning of substantive scientific activity in the West. Before presenting hard-core data a brief review of the background of Shankaracharya and the Mathas is presented.

The time Marker-6 at 509 BCE is the birth year of Shankaracharya. This great thinker and philosopher has been a towering personality in the historical and spiritual life of India. The word Shankaracharya is the euphonic combination of the words Shankar and *acharya* where

the first word is the birth name and the second word is a literary title given to a highly learned person with deep knowledge of philosophy and who is a preacher and a teacher of that knowledge. The respectful title Acharya could also appear as a prefix to the name, something similar to the title of 'Doctor' or 'Professor' in contemporary practice. Shankar was an *acharya* in the true sense who taught and interpreted Vedanta Darshan, Upanishads and other ancient Vedic writings with particular emphasis on Vedanta Philosophy. His name in Sanskrit literature appears variously as Acharya Shankar, Jagadguru Shankaracharya, Aadi Shankara and Aadi Shankaracharya. The word *aadi* means 'the first'. The adjective Aadi is added to Shankaracharya to differentiate him from the other Shankaracharyas that followed him in his Adwaita-Vedanta order that he established. He travelled through India preaching Adwaita-Vedanta Philosophy and established the Vedanta order with four Mathas that he established. All caretaker *acharyas* in these monasteries are in fact addressed as Shankaracharya, whatever their birth name may be. This has caused some confusion in determining the time period of Aadi Shankaracharya. This is discussed in detail below.

He was a very brilliant soul, a genius of a man who learnt the important Vedic texts by heart at an early age and completed his education with his guru Govindpaad when he was just 9 years old. His educational achievement by this early age was equivalent to that of a regular student of 25 years or more. At the age of 16 he completed the interpretive translation and commentary of Rishi Vedvyas's Vedanta Sutra. Even today, with disagreements on philosophical principles of his Adwaita-Vedanta, all scholarly people agree that his interpretive translation of Rishi Vedvyas's Vedanta Sutra, is an unparalleled, heart-grabbing, literary creation with mastery of the Sanskrit language. With his interpretation of Rishi Vedvyas's Vedanta Sutra he introduced the philosophy of *A-dwaita* (non-duality) Vedanta, wherein everything in the universe is God. Therefore, at the root, it is a non-duality pantheism philosophy. Since his advent, his philosophy and the Shankaracharya Mathas have attracted scholarly people and have produced some well-known *acharyas*. It is his Adwaita Philosophy that gave birth to what is known today as the Vedanta Society. It is the same society that Swami Vivekananda started in Chicago when he visited North America, to address the Parliament of Religions, held at the Art Institute of Chicago in 1893.

As opposed to the traditional theistic Vedic religion and philosophy, there were two new non-Vedic religions prevalent in India during Shankaracharya's time, Buddhism and Jainism. God had no place in these religions. Shankaracharya decided to oppose these atheistic religions. He had barely crossed his teenage years but he got engaged heavily in many public *shaastraarths* (debates on philosophical and spiritual subjects) with Vedic scholars as well as with Buddhist and Jain philosophers. Shankaracharya with his brilliance impressed scholars, kings, rulers and masses and defeated Buddhist and Jain philosophers in the *shastrarths*. The immediate consequence of this was mass conversions from Buddhism and Jainism back to Vedic religion. Under the aegis of the kings and the rulers of his time he toured throughout India. In his short-lived life of 32 years, this brilliant young monk brought a historical transformation in the Indian society in re-establishing theistic philosophy.

The Shankaracharya Mathas continue to be the seats of learning and highly revered *ashrams*. The *ashram* at Kanchi-Kamkoti in South India, where Shankaracharya lived his last years, naturally assumed the status of the fifth Matha in his order. Now there are many Vedanta Society ashrams all over India and in many other countries. The historic tradition of appointing a figurehead caretaker *acharya* as a successor at a monastery was started by Shankaracharya himself which continues till today. The continuity of this tradition in some of the originally

established five Mathas enables a historical connection to the antiquity of India over the span of the past two and a half millennia. The links in this chain of continuity are the *acharyas* who were successively appointed at the Mathas and the literature that was created there which gives insight into both, the philosophy and the historical records of administrative nature. The well-preserved and well-guarded written records at the Mathas that include the succession-order of caretaker *acharyas* from Aadi Shankar down to the present times happen to be of immediate interest to this author. It is this material that takes one from the present to the past over two and a half millennia ago, right to the date of birth of Aadi Shankar. It is all history. It is this historical material that has proven to be the most valuable evidence to resolve the confusion created by some of the Western scholars that is blindly accepted by quite a large section of scholarly Indians including the followers of the Adwaita Philosophy. These historical records will help us disprove the time Marker-6B on the Timeline-B.

Shankaracharya himself established the order of Adwaita Philosophy and the Shankar-Mathas to go with it. The well-established Mathas and their disciplined operation have carried the historical records forward with remarkable continuity. Yet what one finds is that Shankaracharya's period is as much in historical confusion as any other period in Hindu religion. This is because those who have researched in this area have used a limited set of data without exploring a large amount of material available at these Mathas. Using scant information from Shringeri Matha and based on the book entitled- 'Vivad', the period erroneously assigned to Aadi Shankar is 684 CE to 716 CE. Also, based on one or two *shlokas* created by an unknown author, the birth of Shankaracharya is said to be in 787/788 CE. As shown below, none of these numbers make sense. The literature found at Shringeri Matha assigns Shankar's birth in 684 CE while the two *shlokas* assign it to be 788 CE with a difference of over 100 years. Obviously this cannot be correct. Acharya Udayaveer Shastri has set the record straight in his book VDKI.

Acharya Udayaveer Shastri in VDKI points out a well-known fact that the Shringeri Matha remained in a destroyed condition and was non-operational without caretaker *acharyas* for a long period of at least 700 to 800 years. Therefore any historical information from Shringeri Matha is not as reliable as from the other Mathas. Nevertheless, the literature from Shringeri Matha has been used by some scholars and some Western Indologists to assign the historical period for Shankaracharya and most historians have unquestioningly followed this and have been repeating the wrong information in their own writings. Contrary to this, the recorded data from the other Mathas, with remarkable continuity clearly delineates that Aadi Shankaracharya was born in 509 BCE. This means a discrepancy of 1300 years. The irony has been that many research scholars have worked in this subject area and wrote their dissertations, yet they were not able to find the birth place of Shankaracharya till the caretaker Shankaracharya of Shringeri, Acharya Nrisinhbharati (1879-1912) himself determined it from the records of the Mathas. He determined that Aadi Shankar's birth place was Kalady in the state of Kerala. Yet these Indologists and their followers insisted that Shankaracharya was born in the 8$^{th}$ or 9$^{th}$ century CE. For fear of losing face they defended their poorly thought out conclusions.

Considerable original literature was created at the Mathas over the centuries that needed to be studied and examined for shedding light on the history of Adwaita Vedanta, particularly about the disputed period of Aadi Shankaracharya himself. It was Acharya Udayaveer Shastri, no relation to the Mathas or to the Acharyas at the Mathas, who conducted deep research in the Matha literature and the preserved historical records in the five Mathas to set the record

straight. Very carefully he established, step-by-step, the true details regarding the advent of Shankaracharya. Acharya Udayaveer in his VDKI has not only presented the historical aspect of Shankaracharya's period but has also presented voluminous historical information on the Sanskrit Literature, at Shankaracharya monasteries. Being personally close to three current Shankaracharyas of different monasteries, Acharya Udayaveer Shastri received from these monasteries very valuable research material, well-protected and preserved in the form of written records. Based on his book VDKI this author has gained considerable historical insight into the period from Aadi Shankaracharya to the present time. This author's limited attempt in this book relates:

- to establish the validity of the time Marker-6 on the Timeline-A
- to establish a relationship between the calendars of three eras, Yudhishthir (YE), Kali-Yuga (KE) and Vikramaditya (VE) that have been utilized for record-keeping at the monasteries
- to establish that the Marker-4 at 3140 BCE is historically valid

The Shankaracharya Mathas are held in high reverence by the Hindu society. The four Mathas originally established by Aadi Shankaracharya himself are:

(1) Jyotir-Matha at Badrinath (Uttaranchal Pradesh in North India)
(2) Sharada-Matha at Dwarka (Gujarat State in Western India)
(3) Shringeri-Matha at Shringeri (Karnataka State in South India)
(4) Govardhan-Matha at Puri (Orrissa State in Eastern India)

These Mathas are marked on the map of India in Figure 3.6 including Adi Shankar's birth place, Kalady in the Kerala State. With the help of King Sudhanva, Shankar in his short life-span covered north-south and east-west regions throughout India. The chronology of the Mathas that he established is in the same sequence as listed above, starting from Badrikashram (Badri Nath) in the Himalaya where he established the first Matha (marked by the number (1) on the map). To give the reader some idea of the distances that young Shankar covered in his short life, the direct distance between his birth-place Kalady near the southern tip of India to Badri in the Himalaya is about 2,250 km. The other direct distances are: between Mathas (1) and (2) about 1,450 km, between (2) and (3) it is about 1,000 km, between (3) and (4) it is about 1,200 km and between (4) and (5) it is about 900 km. Since the travel in 500 BCE was quite arduous, on foot or on horseback, over difficult terrain, young Shankar's travel itself was an unparalleled feat.

After establishing these four Mathas he went to live at an ashram in Kanchi-Kamkoti till he left his mortal body. Therefore the ashram at Kanchi has acquired the same status as the other four Mathas that Shankaracharya himself established. In addition to a Shankaracharya monastery being addressed as Matha it is also addressed as a Peetha, meaning 'the seat'. Shankaracharya formally appointed (ordained) an *acharya* at each Peetha from among his students and followers of high intellectual caliber who served as the caretakers of the assigned Peethas. Since then, it is the tradition at the Peethas that the caretaker *acharya* will choose an able successor when he decides to renounce the seat for a total monastic life for meditation and self-realization. Just as Shankaracharya's birth name was Shankar and a*charya* was the title of respect for a learned teacher at a high level, a caretaker *acharya* has a birth name but traditionally he is also addressed as a Shankaracharya, something similar to the practice at

Vatican where all successive religious heads are called 'the pope'. To differentiate the first Shankaracharya from his successors the adjective Aadi (the first) is added to his name. He is therefore respectfully addressed as Aadi Shankaracharya.

The monasteries have kept written records in terms of dates and necessary details of the important events, particularly the date of appointment of an *acharya* to the Peetha and the date of his leaving. These details have been kept in a chronological order providing considerable historical information. The effort of this author presented in this section is mainly based on the information and data published by Acharya Udayaveer Shastri in VDKI.

The calendar chosen for the record-keeping in these monasteries is either Yudhishthir Era calendar (YE) or Kali-Yuga Era calendar (KE), transiting later into the presently used Vikramaditya (VE) calendar or Shalivahana (SE) calendar. Since the transition from YE and KE to VE in these records is without a break it is therefore a simple matter to establish that Yudhishthir was at the time Marker-4, at 3140 BCE. It is a simple matter because he was a real king and the YE calendar was launched at his coronation after Mahabharata War. When a calendar in the name of a king is introduced in a society, that king has to be a real historical person. The start of the YE and VE are real and provide historical validity for the life and reign of King Yudhishthir five millennia ago and for King Vikramaditya as a real king in the Indian history over two millennia ago.

In general, the process of carrying forward ancient records, involving calendar dates, would have some human element where errors get introduced inadvertently and in some cases some hearsay is erroneously added. Acharya Udayaveer Shastri has discussed this aspect of the history records as well and concluded that there is plenty of other research material at the same Mathas that would help resolve any discrepancies. Acharya Udayaveer Shastri's scholarship as a Vedic literary-historian makes it clear that, there is no discrepancy in determining the period of Aadi Shankar. The data on Aadi Shankar that is presented in tabular form in VDKI has high degree of consistency to draw valuable historical conclusions that help prove this author's Timeline-A.

Acharya Udayaveer Shastri in VDKI has presented tables of *vanshanumaatrika* of the *acharyas* who presided over the Matha administration. A *vanshanumaatrika* chronologically records the *acharya*'s name, year and period of his administration at the Matha. The term *vanshanumaatrika* is commonly used for 'family genealogy'; however, in this case it does not mean that an acharya had family relationship to the previous acharyas. The *vanshanumaatrika* in the context of the Shankar Matha represents only the 'succession order' of the acharyas at a Matha. Acharya Udayaveer Shastri got this information from the records at the Mathas including the succession order at Shringeri Matha where the records are not complete and has been the source of controversy for shortening of the historical period of Aadi Shankar, his birth in 509 BCE to 788 CE. Let us first discuss the valid data and then touch the controversial data.

Acharya Udayaveer Shastri has provided references of the large number of books and the written records that he used to present the succession order at the Mathas. These references are still available at the Mathas for anyone to study. Without going into all the details of his discussion and without presenting the uninterrupted sequence of all acharyas at a Matha, this author has presented in the following an abridged form of Acharya Udayaveer Shastri's tables. Those desiring to see the complete tables are advised to look into VDKI.

**Figure 3.6:** Map of India showing locations of Shankaracharya's Mathas.

In the following are two vanshanumaatrika (succession order) tables (Table 3.4 and 3.5) based on the records kept independently at the Sharada and Kanchi Mathas. These written records give sequentially the name of the caretaker acharya and the start and end of his period as a caretaker of the monastery.

## Records at Sharda Matha

The record on vanshanumaatrika of acharyas at Sharada Matha in Gujarat State (Table 3.4) begins with the Acharya named Brahmswaroop. The name Brahmswaroop is the guru-given name to Sureshvaracharya; Aadi Shankar being his guru. It is indisputably accepted that Sureshvaracharya, a scholarly pundit was his first disciple. He was appointed as the first acharya of Sharada Matha by Aadi Shankar himself. He continued to be close to Aadi Shankar till Aadi Shankar died.

The Table 3.4 provides the connection between the Yudhishthir Era (YE) and Vikramaditya Era (VE) and therefore with the Common Era/Christian Era (CE). These two tables are an abridged form of the complete tables in VDKI. The entries in the last column with CE calendar years are not from Sharda Matha data, they are entered by Acharya Udayaveer Shastri for readers' benefit.

The unbroken sequence of presiding acharyas at Sharda Matha, without missing a single acharya, beginning from 491 BCE to 1945 CE is in VDKI. This compete list ends with

the entry of the present Acharya of Sharda Matha, Abhinavsachidanand-teertha, when Acharya Udayaveer Shastri finished writing VDKI in 1991CE.

**Table 3.4: The succession order of Shankaracharyas at Sharda Matha at Dwarka (Gujarat State). The data are from the records preserved at Sharda Matha.**

| S. No. | Sharda-Matha Name of Acharya | Indian Era From To | Pres. Yrs | Christian Era estimate From To |
|---|---|---|---|---|
| 1 | Brahmsvaroop (Sureshvar) | 2649 - 2691 YE | 42 | 491 - 449 BCE |
| 2 | Chinsukh | 271 5 YE | 24 | 449 - 425 |
| 3 | Sarvagyan | 277 4 YE | 59 | 425 - 366 |
| -- | sequence continuous 4 to 8 (VDKI, p317) | --- | --- | --- -- |
| 9 | Brahmjyotsn | 3040 YE | 32 | 132 - 100 BCE |
| 10* | Anandavirbhav | 3040 YE to 9 VE | 52 | 100 - 48 BCE |
| 11 | Kaladhitirth | 82 VE | 73 | 48BCE- 25 CE |
| 12 | Chidvilas | 119 VE | 37 | 25 - 62 CE |
| 13 | Vibhutyanand | 154 VE | 35 | 62 - 97 CE |
| 14 | Sphoortinilaypad | 203 VE | 49 | 97 -146 CE |
| -- | sequence continuous 15 to 25 (VDKI, p318) | --- | --- | --- |

| | | | | |
|---|---|---|---|---|
| **26** | **Narayanashram** | **836 VE** | **37** | **742 - 779 CE** |
| **27** | **Vaikunthashram** | **885 VE** | **49** | **779 – 828 CE** |
| **28** | **Vikramashram** | **911 VE** | **26** | **828 - 854 CE** |
| **--** | **sequence continuous 29 to 75 (VDKI, p318 -320)** | **---** | **---** | **--- ---** |
| **76** | **Chandrashekharashram** | **200 2 VE** | **20** | **1925 - 1945 CE** |
| **77 **** | **Ahinavsachidanand-teertha** | **Present Acharya** | | **1945 CE ---** |

**Note:** *change in Era from Yudhishthir to Vikram at serial number 10, **till VDKI published in 1991CE

## Calendar Relationship in Sharda Matha Data

An important point to note from this table is the date of the entry at the 10th *acharya* when the Matha switched from Yudhishthir Era (YE) calendar to Vikram Era (VE) calendar. This right away provides the correlation between the two calendars. The fact that the 10th *acharya*, Anandavirbhav, was seated at the Sharda Matha for 52 years starting in 3040 YE and ending in 3040+52 = 3092 YE was recorded in the table as 9 VE. Therefore, the relationship between YE and VE is positively established that 3092 – 9 = 3083 Yudhishthir Era (YE) is 0 Vikram Era (VE) which is same as 57 BCE. Hence the YE began at 3083+57= 3140 BCE. This is what was laid down as the Marker-4 on the Timeline-A in Figure 3.1.

**Records at Kanchi-Kamkoti Matha**

| **Table 3.5: The succession order and Presiding Yrs. of** | |
|---|---|

| Shankaracharyas at Kanchi-Kamkoti Matha, based on the records preserved at Kanchipuram in Tamil Nadu State, is given below. All serial numbers 1 to 68 are continuous. The table is abridged arbitrarily by this author. | | | | |
|---|---|---|---|---|
| **S. No.** | **Kanchi-Matha Name of Acharya** | **Pres. Yrs** | **Indian Era (Last Year of Acharya in KE,VE)** | **Common Era (Last year)** |
| **1** | **Shree Shankaracharya** | **6** | **2626 KE** | **476 BCE** |
| **2** | **Sureshvaracharya** | **70** | **2696 KE** | **406 BCE** |
| **--** | **Continued…3 to 6** | **---** | **---** | **---** |
| **7** | **Anandgyan** | **69** | **3047 KE** | **55 BCE** |
| **8** | **Kaivalyanand** | **83** | **3130 KE** | **28 CE** |
| **9** | **Kripashankar (2)** | **41** | **3171 KE** | **69 CE** |
| **--** | **sequence continuous 10 to 14 (VDKI, p323)** | **---** | **---** | **---** |
| **15** | **Gangadhar (1)** | **12** | **3431 KE** | **329 CE** |
| **16** | **Ujjval Shankar (3)** | **38** | **3469 KE , 424 VE** | **367 CE** |
| **17** | **Sadashiv** | **8** | **3477 KE 432VE** | **375 CE** |
| **--** | **sequence continuous 18 to 35 (VDKI, p323-324)** | **---** | **---** | **---** |
| **36** | **Chitsukhanand** | **21** | **3860 KE , 815** | **758 CE** |

| | | | | |
|---|---|---|---|---|
| | | | **VE** | |
| **37*** | **Vidyadhan** | **30** | **3830 KE , 845 VE** | **788 CE** |
| **38**** | **Abhinav-shankar (5)** | **52** | **3942 KE . 897 VE** | **840 CE** |
| **--** | **sequence continuous 39 to 65 (VDKI, p324-325)** | **---** | **---** | **---** |
| **66** | **Chandrashekher(6)** | **17** | **5010 KE, 1965 VE** | **1908 CE** |
| **67** | **Mahadev (8)** | **7 days** | **5010 KE, 1965 VE** | **1908 CE** |
| **68 *** ** | **Chandrashekherendra Sarasvati** | **---** | **Present Acharya, 1965 VE --** | **1908 CE --** |

**Notes:** * Indologists theorized Aadi Shankaracharya's advent in 788 CE when Vidyadhan was the care-taker *acharya* at Kanchi Kamkoti Matha.

** The term 'shankar' in Abhinav-shankar's name was perhaps the reason why Western scholars thought that he was Aadi Shankaracharya, *** till VDKI was published in 1991CE

The record keeping in the Mathas were were not carried out in the Common Era (CE) dates as in the last column of Table 3.4. The last column entries in equivalent CE are by Acharya Udayaveer Shastri after he confirmed the correlation between the three calendars. To bring out the correlation between the three calendars, this author has presented only the necessary truncated entries from the unbroken continuous entries in VDKI. The Emperor Yudhishthir in 3140 BCE, Emperor Vikramaditya in 57 BCE and Jesus Christ at zero BCE are all real people of ancient history.

The first entry in Table 3.4 reveals that Aadi Shankaracharya's period was around 491 BCE when he appointed his first disciple Brahmsvaroop (Sureshvar) as the first caretaker Acharya of Sharda Matha.

Now let us look at yet another historical record, independently kept at Kanchi-Kamkoti Matha (labeled 5 on the map in Figure 3.6, starting from Shankaracharya up until the present acharya. The Kanchi Matha records are presented in Table 3.5. These data were recorded in a format different from the records at Sharda Matha (labeled 2 on the map, Figure 3.6). Notice that the entries are in number of years (third column) that an acharya presided over the Peetha of the Matha, followed by the column (fourth column) recording the year of the end of his administration.

Compared to the record at Sharda Matha in Table 3.4 the important feature to note from the fourth column of the Table 3.5 is the use of Kali-Yuga Era (KE) instead of Yudhishthir Era. Also from the 16th entry onwards, both, the KE and VE are entered till the end of the table. Plentiful historical information can therefore be extracted from these data in two different calendars. It becomes obvious from several of these differing features in the recording formats that the record-keeping at different Mathas was independent of each other. They ought to be independent because the straight geographic distance between the two Mathas is over 1,700 km and in those early days the mode of travel was on foot or on horse-back through thick forests of South India, making travel difficult between the Mathas

## Kanchi Data Confirms Relationship between Calendars

Notice that in Kanchi Kamkoti Table 3.5 the calendar entries from the 16th *acharya* onwards in the 4th column are in two calendars, Kali-yuga Era (KE) and Vikram Era (VE). Picking any double entry in the fourth column yields a relationship in KE and VE. The calendar years at the 16th entry for the Acharya Ujjval Shankar (3) are 3469 KE and 424 VE. With VE being 57 years more than CE the corresponding CE to 424 VE is 367 CE. Therefore, in terms of CE the onset of Kali-Yuga Era is 3469-367 =3102 BCE. This is shown by the Marker-5 on the Timeline-A in Figure 3.1. The difference between the YE at 3140 BCE and KE at 3102 BCE being 38 years, is consistent with the genealogy of the kings at Delhi and Krishn's passing near the onset of Kali Yuga which is stated in the Mahabharata and the Puranas.

The bracketed numeral against an *acharya*'s name represents the number of repetitions of the word 'shankar' in the succession since the beginning of the Shankaracharya's order. The Table 3.5 for Kanchi has Aadi Shankaracharya as its first presiding *acharya* and Sureshvaracharya succeeding him. This is natural for the fact that Shankaracharya lived there for his last six years and his devoted first disciple Sureshvaracharya took charge of Kanchi, even though he was appointed as the first Acharya at Sharda Matha.

The very first *acharya* in the Kanchi succession order is Shree Shankaracharya; Shree being the adjective for respect and reverence in the same way as in Shree Krishn and Shree Ram. Aadi Shankar presided over the Peeta only for 6 years till 2626 KE. Shankaracharya's administration ended with his death in 2626 KE which is 476 BCE. If the age of Aadi Shankar is rounded off to 33 years and added to this figure one gets 509 BCE for Aadi Shankaracharya's birth year. The very first Acharya in the Table 3.5 is none other than Aadi Shankaracharya. This is consistent with the dates of events in Shankaracharya's life recorded at Sharda Matha, presented in Table 3.6. One other point to note from the Table 3.5 is that the second *acharya* after Aadi Shankaracharya is Aadi Shankar's first disciple Sureshvaracharya whose guru-given name is Brahmswaroop as the first caretaker Acharya of Sharada Matha. Sureshvaracharya's presence at Kanchi-Kamkoti Matha is natural because this most devoted disciple spent time with his guru during the period of the guru's ill-health and his last days. Sureshvaracharya-Brahmswaroop remained in charge of both Mathas with an overlap of about 28 years after which he appointed Chinsukhacharya at Sharda Matha; he himself remained at Kanchi-Kamkoti ashram.

While Sharda Matha completely switched the calendar from the YE to the VE in the first century CE, the Kanchi Matha continued entries in both, KE and VE, till the fifth century CE. The reason for the switch or to have both eras entered is that by that time the Vikram Era calendar was extensively in use in the society. This further suggests that one Matha did not

automatically copy data from the other. Rather, the entries were made in different formats independently, at two different places, geographically separated with considerable distance.

The written records at these Mathas are not limited to recording the succession order of presiding Acharyas at the Mathas. They contain much more valuable information that should open the eyes of those historians who have been blindly following the word of the Western researchers. Without going into all the details that Acharya Udayaveer Shastri researched and presented in VDKI, this author has presented here several important dates related to Aadi Shankar's life to take the reader to the beginning of the sixth century BCE when Shankar was born and lived. Based on Sharda Matha data the important dates related to Aadi Shankar are summarized in Table 3.6. This author has added the bracketed explanation of the terms in the first column, the month/day/year in the second column and the closest CE year in the last column.

**Table 3.6: Based on the records at Sharda Matha in Dwarka (Gujarat State) the dates relate to Aadi Shankaracharya's life.**

| Events in Shankar's life | Date in Yudhishthir Samvat (YE) (month/day/year) | Closest CE |
|---|---|---|
| Janma (birth) | Baishakha, shukla panchami, 2631 YE (2/5/2631 YE) | 509 BCE |
| Upnayan (thread ceremony) | Chaitra Shukla Navmi, 2636 YE. (1/9/2636 YE) | 504 BCE |
| Sanyas (monk ceremony ) | Kartik Shukla ekadashi, 2639 YE (8/11/2639 YE) | 501BCE |
| Siksha (education) | till Falgun Shukla Dveetiya, 2640 YE (12/2/2640 YE) | 500 BCE |
| Vedanta-Bhasya, other writings (Badri Ashram) | till Jeshtha Badi Amavashya, 2646YE (3/30/2646 YE) | 494 BCE |
| Dehaavasaan (death) | Kartik Paurnamaasi, 2663 YE (8/15/2663 YE) | 477 BCE |

The dates for the events in Shankaracharya's life are all recorded in Yudhishthir Samvat (YE) where the name of the month, lunar-day with lunar phase of *shukla* (bright phase) or *badi* (dark phase) preced the year in YE. This record is remarkably detailed and complete. To keep

the table short this author did not include other dates that are in VDKI that relate to Shankaracharya's meetings with the kings and other scholarly people.

A well-known fact which all historians would accept is that Aadi Shankar lived only for 32 years. The record in Table 3.6 shows that he lived exactly for 32 years 6 months and 10 days. Another important feature of this record is that it is in Yudhishthir calendar, a calendar in use at that time. It also suggests that the onset of Yudhishthir calendar was 2,631 years before Aadi Shankar's birth, which in Common Era calendar is 509 BCE. The sum of the two numbers is 3140 BCE, a number at the Marker-4 on Timeline-A (Figure 3.1) that we have been talking about all along. On one hand there are records from Sharda Matha at Dwarka revealing that Shankar was born in 509 BCE (exact date of birth given in Table 3.6) and on the other hand there are some modern historians hypothesizing his advent in 788 CE, 1,300 years later. If the Indian history hypothesized by these Western historians is accepted, which is also followed by many Indian historians, one has to follow the timeline similar to the Timeline-B (Figure 3.1) where Aadi Shankar is found at the Marker-6B at 788 CE. There is no provable solid argument to suggest that the Sharda Matha data are less reliable than the hypothesis put forward by these Indologists and modern historians.

**Table 3.7: Dates of construction and establishment of Shankaracharya Mathas. The serial numbers of the Mathas are shown on India's map in Figure 3.6.**

| | Matha Name | Place and State | Date Established | Date in CE |
|---|---|---|---|---|
| 1 | Jyotir-Matha | Badri-ashram[1] (Uttaranchal) | 2641YE to 2645 YE | 499 to 495 BCE |
| 2 | Sharda Matha | Dwarka[2] (Gujarat) | Kartik badi trayodashi, 2648 YE | October, 492 BCE |
| 3 | Shringeri Matha | Shringeri (Karnataka) | Falgun shukla navmi, 2648 YE | February, 492 BCE |
| 4 | Govardhan | Puri | Vaishakh | April 485 |

| | | | | |
|---|---|---|---|---|
| | **Matha** | **(Orrissa)** | **shukla dashmi, 2655 YE** | **BCE** |
| **5** | **Kanchi-Kamkoti[3] Matha** | **Kanchi (Tamilnadu)** | **2620 KE[4]** | **482 BCE** |

**Notes:** [1]Badri-ashram, a pilgrim place, the possible place of Rishi Baadrayan Vedvyas the author of Vedanta Sutra and Mahabharata.

[2]Dwarka is where Krishn established his second capital and ruled till his passing close to 3102 BCE. It is the legendary city that went under the sea and has been rediscovered recently.

[3]After establishing the fourth Matha at Puri, Aadi Shankar went to live at a preexisting ashram/temple at Kanchi which also started to function as the fifth Matha.

The following discussion further strengthens the validity of the Timeline-A and further weakens the premise of the Timeline-B.

The next set of data from Sharda Matha in Table 3.7 gives information on the date of construction of the four Mathas that Aadi Shankar himself supervised. The foot-notes under the table are added for the reader's benefit.

Building a home or an important structure is an auspicious occasion in Indian tradition and culture. The building process has a ceremonial beginning and completion. The beginning act of laying the foundation stone is termed as *shilanyaas* and the first entry by the owner after the completion is termed as *grihapravesh*. Brought up in the Vedic tradition and being a great proponent of it too, Acharya Shankar would not begin and end the Matha construction any differently. Therefore one should not be surprised to find the construction year of each of the four Mathas on record. Note that the year of the beginning and the year of completion of the first Matha at Badri are recorded in YE. For the next three Mathas the date of completion (*grihapravesh*) was recorded in terms of the month and day with lunar-phase in Yudhishthir Samvat. This is no fiction; the life and practices at the time of Aadi Shankar indicate a high level of civilization with meticulous record-keeping and preserving of history. The date of initiation of the Matha at Kanchi-Kamkoti over 1,700 km away from Sharda Matha was independently recorded in the Kali Yuga calendar year. The calendar year there is 2620 KE which corresponds to 482 BCE. This is the ashram where Aadi Shankar spent his last six years.

One simple conclusion from this table is that all these five Mathas were established in the same order as accepted by most scholars and that is corroborated by the information of Shankaracharya's travels. Based on historical data from Kanchi Matha presented in the Table 3.7 it is obvious that Aadi Shankar presided over the Kanchi Matha himself for only 6 years. This takes us to 476 BCE and if the Sharda Matha data are assumed to be correct, the time span between his birth in 509 BCE and 476 BCE is about 33 years. This coincides with the undisputed fact that he lived for a period of 32 years, which is not very different from the fact that he lived for 32 years 6 months and 10 days as shown in Sharda Matha records (Table 3.6).

### The Erroneous Shringeri Matha Data

It was mentioned above that the scant information from Shringeri Matha was the basis for the hypothesis that Aadi Shankar was born in the seventh century CE. Also the two or three

different views that place Shankar in the seventh and eighth centuries are contradictory to each other and are both without foundation.

**Table 3.8: Succession order of acharyas at Shringeri Matha.**

| | Acharya Name | From (CE) | To (CE) | Presiding Period (yrs) |
|---|---|---|---|---|
| 1 | Aadi Shankaracharya | 684 | 716 | 32 |
| 2 | Sureshvaracharya | 712 | 773 | 60/61 |
| 3* | Nityabodhghanacharya | 773 | 848 | 75 |
| 4 | Gyanghanacharya | 848 | 910 | 62 |
| 5 to 33 | --- sequence continued --- | --- | --- | --- |
| 34 | ChandrashekherBharti (3) | 1912 | 1954 | 42 |
| 35 | Abhinavvidyatirth | 1954 | -- | Present *Acharya* |

**Note:** *Modern scholars place Aadi Shankar in this period

The controversial Shringeri Matha data are presented in the Table 3.8 where the caretaker acharyas are listed with their administration periods. The list begins in 684 CE with Aadi Shankar and ends in 1954 CE with the present Acharya (when VDKI was completed). The total count of acharyas at Shringeri is 35 compared to 77 at Sharda Matha, 68 at Kanchi and 144 for Govardhan Matha. For the sake of brevity only the first four and the last two acharyas are shown in this table.

The records of Sharda Matha at Dwarka show the date of the establishment of Shringeri Matha in February 492 BCE (not 684 CE) and there is no date of the establishment within the accuracy of a month available in the Shringeri records. If the date of the first entry in this table is assumed to be the date of the establishment of Shringeri Matha it creates a discrepancy of 1,176 years. Except for the Shringeri Matha, all other *mathas* listed in this text are consistent within them.

A well-known historical fact is that Aadi Shankaracharya's first disciple was Sureshvaracharya. Therefore, it would seem logical at a first glance of the Table 3.8 that Aadi Shankar himself presided over the Shringeri Matha and then handed the charge over to Sureshvaracharya before Aadi Shankar died. It is also an undisputed fact that Aadi Shankar lived only for about 32 years: 32 years 6 months and 10 days to be exact according to the Table 3.6 based on the records at Sharda Matha. The Table 3.8 based on Shringeri dates suggests that Aadi Shankar served at Shringeri from 684 CE to 716 CE which is 32 years. Obviously, there is a problem with the record because Shringeri Matha was established by Aadi Shankar after he established the Mathas at Badrinath and Dwarka and his last Matha was at Puri and final residence was at Kanchi-Kamkoti and not Shringeri. Aadi Shankar was not born at Shringeri nor did he supervise Shringeri all his life from birth. By the time he started supervising the

Matha building at Shringeri, he was about 17 years old. Therefore, at the most he could preside over Shringeri Peetha for 15 years during his remaining life and not 32 years. The numbers do not add up for those placing Aadi Shankar in the 8th century CE.

Without going into the details of Acharya Udayaveer Shastri's explanation of this discrepancy it is concluded here that the first two entries in the Table 3.8 are intentional and based on ignorance of Aadi Shankar's life and period. As discussed in VDKI (page 334) this could also be the result of a well-known ongoing rivalry between Shringeri and Kanchi-Kamkoti Mathas. It seems this rivalry continues to exist even today.

Based on VDKI (page 338) it is also well-known that the Shringeri Matha was in a destroyed condition and non-operational for at least a period of 700 to 800 years and remained without caretaker *acharyas* for 500 years. This discontinuity is also not shown in the Shringeri data. The first two erroneous entries at Shringeri perhaps are to lay claim to importance and status by having Aadi Shankaracharya and his first disciple Sureshvaracharya at the top of their succession order.

The profound research into Matha literature presented by Acharya Udayaveer Shastri in his book, 'Vedanta Darshan Ka Itihaas' (VDKI) provides direct benefit to the present author for proving the Reference Hypothesis. The Matha history provides unambiguous connection between four calendars used for recording the succession order of Matha Acharyas; the 4th calendar being the Shalivahan Era (SV) calendar. Since Vikram Era undisputedly began 57 years before CE, it was straightforward to establish a relationship between Yudhishthir Era (YE), Vikram Era (VE) and Common/Christian Era (CE), as shown in Table 3.4 and also to establish a relationship between Kali-yuga Era (KE), VE and CE as shown in Table 3.5. Therefore, the year of Yudhishthir's coronation at the end of Mahabharata War and the onset of Kali Yuga are accurately established to be 3140 BCE and 3102 BCE respectively. This further validates all the time-milestones on the Timeline-A.

The written records discussed in this chapter regarding Manusmriti, the discovery of the extinct River Sarasvati, Megasthenes' account in his book Indika, genealogies of Kashmir Aryan kings in the book Rajtarangini, the Satyarth Prakash account of the Aryan kings at Delhi and the historical records at the Shankaracharya Mathas all now confirm without a shred of doubt that Mahabharata is part of the Aryan history and the YE, KE, VE calendars have been as genuine as the CE calendar. The onset of these calendars respectively in 3140 BCE, 3102 BCE and 57 BCE is also a validation for the Reference Hypothesis that the Vedas are anterior to Mahabharata and therefore the Veda mantras in the Vedas are very ancient. The author is confident that the historical references provided here, followed by the discussion of the information and the logical conclusions drawn, all provide solid support for the Reference Hypothesis that the mantra references used to build the Vedic Cosmology Scenario in this book are older than 5,000 years, unaffected by modern science and philosophy.

## Genetic Research under National Genome Projects

This final section of the chapter brings in references from the state-of-the-art comprehensive genetic research carried out on the Indian populace covering the north-south, east-west regions, all dialects, all castes ranging from brahmans to *shudra* including the *aadi-vasis* (tribal-people and forest dwellers), black and fair complexioned people and all those branded by Aryan Hypothesis (AH) as the Aryans of the north and the Dravidians of the south. The National Genome Projects in collaboration with other international geneticists have discovered that all groups of Indians mentioned above, have within the acceptable scientific

margin of error, the same DNA and that their DNA is different from all those who are exterior to India. These studies have also brought out the fact that the Indians with this common DNA have been on the Indian sub-continent well before the Holocene geological epoch exceeding 10,000 - 15,000 years in the past, going into the Pleistocene epoch extending from 12,000 years to 2.5 million years. The Vedic people of this sub-continent have been saying all along that the Vedas and the Vedic culture are extremely ancient. The Aryans of India did not come from elsewhere and the people of India are all Aryans. The Aryan Invasion Theory (AIT), a brain-child of Max Muller et al. has been debunked!

Indian phylogeny cannot be separated from Sanskrit Literature. The Sanskrit Literature is about the people of Aryavart, their culture, religion and philosophy, the people who addressed themselves as the '*arya*' (Aryan). The term *arya*, as explained before has no connotation of race or caste. The specific subject of 'traditional genealogy', a research discipline unto itself in the science arena employing multi-variate parameter analysis for a population is briefly discussed in the following.

When genetics, a branch in biology, is applied to 'traditional genealogy' it is called the 'genetic genealogy' where biological information contained in the nucleus of the cell of a living being is subjected to scientific scrutiny. This means testing genealogy by scientific techniques and methodology. Since the genetic research discussed in the following is important for defining the Indian populace in the context of different tribes, castes, languages and other genetic factors as well as in the context of the Indian phylogeny's connection to people outside India by way of agricultural migration or invasion as proposed in AIT, it was thought essential for the benefit of the reader that essential terms in genetics be defined first and then its application to Indian phylogeny be discussed**.**

The underlying question to be answered is, when and from where did the original founding population come to the Indian sub-continent, given the fact that the number of subsequent invaders compared to the continuing host population is negligibly smaller. The question relates to those inhabitants who developed Vedic philosophy and created the vast Sanskrit Literature 5,000 years ago and before. This question is answered on a scientific basis through the genetic studies and the answer, as mentioned above, is that these Indians have been on this continent well before the Holocene geological epoch exceeding 10,000 - 15,000 years.

Biological information in the cell of a living being is contained in its genome which is encoded in its DNA (DeoxyriboNucleic Acid). DNA is a specific assemblage of genes, which are discretely-defined units of molecular assemblage, which ultimately are formed out of carbon, oxygen, hydrogen, nitrogen and other elements in small proportions including some other trace elements. Thus the 'genetic genealogy' is part of the molecular biology. Within the mind-boggling complexity of a living cell itself there are certain molecular assemblages in it that are transferred from one generation to the next that help identify the biological connection between the generations. This is commonly called the inheritance of genes from parents. Among other genes that are transferred, it is the biological information contained in the Y-chromosome or Y-DNA that is of great interest in genetic research because it is passed exclusively from father to son establishing the paternal line from generation to generation. Mitochondrial-DNA or mtDNA on the other hand comes from the mother and therefore is used for tracing the maternal line. It is the mtDNA that has been studied to identify an ancient maternal lineage from which modern man evolved.

A most commonly used term in molecular biology is 'haploid'—having only a single set of homologous chromosomes. When the molecular evolution in species is studied, a haplogroup (HG) of similar haplotypes that share a common ancestor with the same DNA sequence variation is analyzed. To differentiate between haplogroups, they are identified by letters of the alphabet and numerals. In this nomenclature the different designations are assigned to Y-DNA and mtDNA.

The genetic research on human populations confined within different countries is relatively recent. Most important studies have been published within a decade or so. A review of these studies is beyond the scope of this book. Among other large number of publications, the reader is urged to read two important research papers on Indian genome studies that have provided extensive and up to date lists of references on the subject and published genetic studies on the Indian population, utilizing state-of-the-art technology and research tools. These studies have been conducted under the national genome programs of India in collaboration with a large number of national and international research institutes and universities. These studies have also included genetic data from the countries and regions outside India that were thought to have had some influence on the Indian genome. These two independent publications are: (superscript represents author's affiliation).

**(A)** '*A prehistory of Indian Y chromosomes: Evaluating demic diffusion scenario*'', by

S. Sahoo[1], A. Singh[1], G. Himabindu[1], J. Bererjee[1], T. Sitalaximi[1], S. Gaikwad[1], R. Trivedi[1], P. Endicott[2], T. Kivisild[3], M. Metspalu[3], R. Villems[3] and V. K. Kashyap[4]; (published in) *Proceedings of the National Academy of Sciences of the United States of America, Vol. 103, no. 4, 843-848, January 24, 2006.*

[1] National DNA Analysis Centre, Central Forensic Science Laboratory, Kolkata, India; [2] Department of Zoology, University of Oxford, Oxford, UK; [3]Estonia Biocentre, Tartu, Estonia; [4]National Institute of Biologicals, Noida, India.

**(B)** '*Polarity and Temporality of High-Resolution Y-Chromosome Distributions in India Identify both Indigenous and Exogenous Expansions and Reveal Minor Genetic Influence of Central Asian Pastoralists*', by

S. Sengupta[5], L.A. Zhivotovsky[6], R. King[7], S. Q. Mehdi[8], C. A. Edmonds[7], C-E. T. Chow[7], A. A. Lin[7], M. Mitra[9], S. K. Sil[10], A. Ramesh[11], M.V. Usha Rani[12], C. M. Thakur[13], L. L. Cavalli-Sforza[7], P. P. Majumder[5], and P. A. Underhill[7], (published in) *The American Journal of Human Genetics, Vol. 78, 202-221, February, 2006.*

[5]Human Genetics Unit, Indian Statistical Institute, Kolkata, India; [6]N.I. Vaiilov Institute of General Genetics, Russian Academy of Sciences, Moscow, Russia; [7]Department of Genetics, Stanford University, Stanford, USA; [8]Biomedical and Genetic Engineering Division, Dr. A.Q. Khan Res. Labs., Islamabad, Pakistan; [9]School of Studies in Anthropology, Pandit Ravishankar Shukla University, Raipur, India; [10]University of Tripura, Tripura, India; [11]Department of Genetics, University of Madras, Chennai, India; [12]Department of Environmental Sciences, Bharathiar University, Coimbtore, India; [13]B. J. Wadia Hospital for Children, Mumbai, India.

It becomes clear from the above list of 27 international participants involving 13 different international institutions of high repute that the outcome of these independent studies is highly reliable and thus is of immense value. These studies have changed the superficial perception

about the inhabitants of India; the reality is that they have lived on this continent since the pre-historic times. These papers have also reviewed the preceding genetic studies on Indian populations that a reader may wish to study.

Two studies with opposite conclusions were carried out before the above cited studies (A) and (B). Kivisild et al. (Americal Journal of Human Genetics, 72, 313-332, 2003) proposed that tribes and castes in India share considerable Pleistocene heritage (from 2.588 million years down to 12,000 years) with limited recent gene-flow between them. Opposite of this was the theory by Cordaux et al. (Curr. Biol., 14, 231-235, 2004), who concluded that the castes and tribes of India have independent origins. The two comprehensive studies (A) and (B) listed above have dealt with these two opposing deductions and have successfully tied the loose-ends. Sahoo et al., the authors of article (A) commented- "*Cordaux et al. defined, heuristically, a package of haplogroups* (J2, R1a, R2, and L) *to be associated with the migration of* IE *people*' (people of Indo-European language group) *and the introduction of the caste system to India, again from Central Asia*." The term *heuristically* of course meant that the genetic sample taken by Cordaux et al. was inadequate and their conclusions were drawn without exhaustive effort.

To study genetic genealogy of a population one collects DNA samples that statistically represent that population. In spite of highly accurate DNA analysis of a sample using state-of-the-art instrumentation in molecular biology one ultimately resorts to statistical analysis of the biological outcome. If the sample is inadequate one comes up with analysis that leads to erroneous conclusions. According to the papers (A) and (B) such was the situation in the study by Cordaux et al. For the studies on genetic research on Indian population with a limited sample that preceded the authors of the two articles (A) and (B) listed above, the authors of the article (B) Sengupta et al, pointed out the limitations and deficiencies of the earlier limited samples thus –

> "*Although such studies have provided interesting insights into the genetic history of paternal lineages in India, there have been two limitations arising from a combination of ethnically ill-defined populations, limited geographic sampling, inadequate molecular resolution and inappropriate statistical methods. Another underappreciated factor in some studies is the innate complexity of caste origins, including the recognition that some castes have tribal origins. The present study* (i.e. the article (2) listed above) *addresses these deficiencies by using a large set of well-defined ethnic groups, wider geographic sampling, high molecular resolution to define HGs, comprehensive haplotyping with use of a large set of microsatellite markers…*"

In addition to these short quotations drawn into this text the information in the two papers (A) and (B) gives exhaustive details on comprehensive data preparation, methodology, testing with most modern tools with high spectral resolution and on careful analysis. The conclusions based on these large mtDNA and Y-chromosomal studies with large number of haplogroups are dramatically opposite to the long-held view that the arrival of nomadic Central Asian pastoralists had shaped the genetic differentiation of India and had also contributed to the development of language, culture and introduced the caste system on this subcontinent. The studies instead have shown that on statistical basis, there is no difference in the genetic makeup of tribes and castes of India as had been surmised heuristically by Cordaux et al. and in several other earlier studies. The basic deduction of the studies is that, '*the age of accumulated microsatellite variation in the majority of Indian haplogroups exceed 10,000-15,000 years*';

leading to the fact that the Indians have been on the Indian sub-continent indigenously for an extremely long time. In terms of geological epochs, the Indians in India, at least since the 'pre-Holocene and Holocene-era', have shaped the distinctive South Asian Y-chromosome landscape and not the Indo-European expansions, attesting to the antiquity of Indian Civilization and its indigenous development.

The archaeological evidence based on findings in the state of Rajasthan that were related to the River Sarasvati and King Manu's *Vinshan Region*, the British Archaeological Reports, Oxford, UK (1982), radiometric dates for South Asian Archaeology (Univ. Pennsylvania, Philadelphia, USA) and many references in journal publications substantiate the fact that the settlement of India by modern humans using Middle Palaeolithic tools dates back to at least the Late Pleistocene period. As suggested by these and other authors the initial settlement of South Asia, between 40,000 and 70,000 years ago was most likely by the southern route from Africa because haplogroup M, the most frequent mtDNA component in India, is virtually absent in the Near East and South West Asia.

The authors of the article (A) analyzed Y-chromosomes from Indian haplogroups in the context of available data from West Asia, East Asia, Southeast Asia, Central Asia, the Near East and Ethiopia. While haplogroups R1, R2, L, O, H, J2 and C characterize more than 90% of the Y-chromosomal variation in all socio-linguistic groups of India, the total frequency of these haplogroups outside India is marginally low. Also the haplogroups E, I, G, J* and R1* dominantly present in the Near East among the Turks and Central Asia are rare or absent in India and haplogroups C3, D, N and O specific to Central Asia and Southeast Asian populations are virtually absent in India. The haplogroups that are found common between these regions and India are recent and not significant and that too exist particularly in Western India and the Indus region. To quote the conclusion from the paper (A):

"*It is not necessary, based on the current evidence, to look beyond South Asia for the origins of the paternal heritage of the majority of the Indians at the time of the onset of settled agriculture. The perennial concept of people, language and agriculture arriving to India together through the northwest corridor does not hold up to close scrutiny*".

The work on the Genome Projects in India has proven AIT to be a discard. It has proven beyond doubt that Aryans are people indigenous to India since at least 40,000 to 70,000 years. The Indians who insist to be Dravidians are in fact as much Aryans as the rest of the Indians. It is time to shed the myths of the Aryan Hypothesis and the Aryan Invasion Theory.

# Dravidian group of Aryans

The Dravidian group of Aryans ought to understand that **द्रविण** or **द्रविड** (*dravin* or *dravid*) are the derivatives from the *yaugik* Vedic terms **द्रविणोदः** or **द्रविणोदाः** (*dravinodah* or *dravinodaah*), wherein the letter 'd' is pronounced soft as in the word 'the'. Both forms of the term द्रविणोद: (*dravinodah*) mean "*one who donates wealth generously for the benefit of others*". This term appears in several mantras of RigVeda in which four successive mantras are devoted to **द्रविणोदाः** (*dravinodaah*) *devata* in the *sukta* 37 of *mandal* (chapter) 2 of RigVeda (2/37/1- 4). When one studies the meaning of these four mantras one learns that the term *dravinoda* in these mantras is used as an adjective and relates to the people who are hardworking, prosperous, scholarly and generous at heart. In these mantras there is no suggestion of race or colour. Just as the Vedic term *arya* does not signify race of a person but means '*eeshvar putra*' (progeny of God) the term *dravid*, originated from the RigVeda, refers to the virtue of generosity in a person. The word *dravinod* has no other connotation and these mantras have no suggestion of belonging to the north or south of India or having a light or dark complexion. All Indians are Aryans.

Swami Dayanand Sarasvati, contemporaneous to Max Muller et al., read about their bogus Aryan Hypothesis and the Aryan Invasion Theory and pointed out their bankruptcy of thought. If Europe can achieve modernity in culture, science and technology within a millennia or two it is not difficult to conceive that the Aryan cultural heritage on the Indian sub-continent, flourishing over a minimum of 40,000 years would have developed Sanskrit, compiled the Vedas, formulated *sutras* and contributed to the vast Sanskrit Literature.

With all the evidence presented in this chapter it can be said with certainty that such spectacular literary activity took place in Aryavart's history, anterior to Mahabharata War close to the Time-Milestone-5 dated February 18, 3102 BCE.

# CHAPTER 4: A Brief Review of Ancient Vedic Literature - the Source of References on Cosmology

> "*In the discussion of philosophical subjects, pre-conceived notions are the worst enemies to encounter. They not only prejudicially bias the mind, but also take away that truthfulness and honest integrity from the soul, which alone are compatible with the righteous pursuit and discernment of TRUTH. In the treatment of a question such as the estimation of the value of a system of philosophy or religion, extreme sobriety and impartiality of the mind are required. Nor is it to be supposed that a religious or a philosophical system can be at once mastered by a mere acquaintance with grammar and language. It is necessary that the mind should, by an adequate previous discipline, be raised to an exalted mental condition, before the recondite and invisible truths of Man and Nature can be comprehended by man. So is it with Vedic philosophy*." (Pundit Guru Datta Vidyarthi in "The Terminology of the Vedas and European Scholars", 1888 CE).

These are the words of Pundit Guru Datta Vidyarthi (1864-1890), preserved in an 1888 CE publication in English, that he authored under the title of "The Terminology of the Vedas and European Scholars". Pundit Guru Datta Vidyarthi was a prolific writer in English with mastery of several languages of the world. Guru Datta's English translations of three Upanishads are splendid literary examples. For his linguistic and scholastic abilities, many accolades were bestowed upon him by the scholarly. Upon reading his essays, the English linguist Frederick Pincott (1836CE – 1896CE) wrote to him – "*There must be very few Indians capable of writing such idiomatic scholarly English; and it is great pleasure to me in communication with so thoughtful and studious a gentleman as yourself. My friend informs me that you are young and I am glad to hear that, for with your industry and attainments you may live to do much good to the cause of enlightenment of India…*"

Unfortunately, as said in his obituary in the journal Arya Patrika, "*A man, an uncommon man, a man extraordinary, a true, deep and profound Sanskrit scholar…dazzlingly brilliant…*", Pundit Guru Datta Vidyarthi died at the age of 26. Most of Pundit Guru Datta Vidyarthi's individual works in literature, numbering over two dozens, are compiled in a book titled – "Works of Pt. Guru Datta Vidyarthi", edited by Dr. Ram Prakash, Professor of Chemistry (Punjab University), published in 1998.

The author in this chapter presents a brief review of the Vedic Literature that has served as the resource for the references on Vedic Cosmology. The Vedic Cosmology is a part of the Vedic Philosophy to which Pundit Guru Datta Vidyarthi's statement in the above, "*…pre-conceived notions are the worst enemies…*" applies and to comprehend the Vedic Literature and to benefit from it "*…the mind should … be raised to an exalted mental condition,…*"

Guru Datta had observed and analyzed the literary environment that persisted over one and a quarter centuries ago. Some of the prominent Western Indologists and Sanskritists of the 19$^{th}$ century, contemporaneous to Guru Datta, approached the Vedic Literature and Vedic Philosophy, wittingly and unwittingly, with pre-conceived notions and prejudice, which they blatantly expressed in their writings. This created a negative impression about the Vedas and the Vedic Literature.

There are several rationales for reviewing the ancient Vedic Literature in this chapter. It will benefit those students who developed high affinity for the Vedas and the Vedic Literature, inside and outside of India, and have been endeavouring to enhance their Vedic knowledge through their university curricula. The review will counter the *pre-conceived notions* of Indologists and Sanskritists that presently serve as the resource for the Vedic studies. In addition to providing a broad list of major literary works in the Vedic Literature this author points out what has enabled the preservation of the Vedic thought and the principles of science and philosophy since the unknown antiquity in the human civilization. This literature is the resource of the mantra and *sutra* references on Vedic Cosmology that are the basis for creating the Vedic scenario for the advent of the universe. The review will also enrich the knowledge base of those brought up in the Hindu tradition who have had reverence for the Vedas and the Vedic Literature but have had limited exposure to the ancient literary treasure.

Because the mantras and *sutras* drawn from the Vedas and the Vedic Literature form the basis for the Vedic principle of creation of the universe developed in Chapter 6 and the Vedic Big Bang Scenario developed in Chapters 7 to 10, it became imperative to address the *pre-conceived notions* and prejudices of the dominant Western Indologists and Sanskritists. It is the Western Indologists and Sanskritists who created false impressions and floated myths devaluing the Vedas and the Vedic Literature. For setting the record straight, this author has discussed briefly, with a touch of physics, the lattice of the Vedic Literature and the fundamentals of the Vedic methodology that created this unique literature with the built-in virtue of self-preservation and invariance, unaffected by non-Vedic influences.

Pundit Guru Datta was greatly inspired by his contemporary Swami Dayanand Sarasvati (1825-1883 CE), referred to several times in the previous chapters pertaining to the Vedic philosophy, the nature of Nature, the Space-entity and other contexts. Swami Dayanand Saraswati, a monk from his teenage years, was a great scholar of Sanskrit, Sanskrit grammar and the Vedas, a social reformer and a prolific writer in Sanskrit and Hindi languages. Based on Sanskrit grammar and the methodology for mantra translation, Swami Dayanand also pointed out with specific examples, the erroneous mantra translations by some prominent Western Indologists and Sanskritists. Nevertheless, the Indologists and Sanskritists continued to publish volumes on India's religion, culture, history and the Sanskrit Literature. The irony of the situation is that some of them had never even set foot on Indian soil. Unfortunately, the ill prepared Western Indologists and Sanskritists ignorantly misunderstood and intentionally misrepresented the rich treasure of knowledge from the ancient Vedic period of India. They left behind scathing commentaries dismissing the value of the incredible contributions of the Vedic *rishis* for furthering the human knowledge. Their negative opinion was widely accepted in the academic circles in the West and in British India.

Guru Datta's above quotation reflects his reaction to the mediocrity in interpretation of the Vedic thought and their biased judgment on Vedic philosophy and culture. In addition to the Upanishad translations in English, Guru Datta unhesitatingly countered the misconception of the Vedas by the Western Sanskritists and Indologists. He expressed this in his superb phraseology in the English language. Some examples of the shortcomings

in the translations and interpretations of the Veda mantras by the Western Sanskritists will follow in this chapter.

The term Vedic Literature includes the four Vedas and the post-Veda Sanskrit Literature. It is vast and arranged in large number of categories. Some categories deal with specific Vedic subjects while the other categories deal with numerous other subjects. The creation of this literature by the Vedic *rishis* and sages took spans of centuries and millennia in the far antiquity of the Indian Aryan Civilization. It includes both, the science and philosophy, covering various subjects of intellectual diligence such as physics, mathematics, astronomy, cosmology, anatomy, medicine, music, philosophy, spirituality, language, grammar, logic, law, history, sociology, governance and various other areas.

The discussion in this chapter will include specifying the components of the Vedic Literature and it will also include a brief commentary on **the myths and misunderstandings created by the Western Indologists and Sanskritists**, namely that –

- the Vedas were composed about 1500 BC (F. Max Muller, in "India - What Can It Teach Us", (IV, VII), Oxford, December 1882)
- the 'Veda is decidedly not monotheistic…the Veda had worship of multitudes of gods and goddesses' (F. Max Muller, in "India - What Can It Teach Us", (VI and chapter VII on Vedic Deities).
- the Indians followed the oral tradition of teaching and learning and 'the writing was unknown in India before the third century BC' (Max Muller, in "India- What Can It Teach Us", (Veda and Vedanta).
- the Indians were not good in recording their history
- the Aryans of India are invaders from Asia Minor and the natives of India are Dravidians (Aryan Invasion Theory and Aryan Hypothesis)

All such misconceptions about the Vedas are debumked in this Chapter.

Western Sanskritists and Indologists, without carrying out adequate research in ancient Vedic history of India, irresponsibly said that the Indians were not good in writing their history. With that pretext, the Western Sanskritists took it upon themselves to set the historical dates for important events in the ancient Indian history and the dates for the advent of important books in Vedic Literature, without providing proof. There have been a good number of these Western scholars, particularly in the late 18th and 19th century when modern writings on Indology began. A few well known from this period are cited in this text. Often referred to in this book is the prominent and dominant Indologist and Sanskritist, Professor Max Muller (1823-1900) of Oxford University in England. With the exception of several German Sanskritists and Indologists, a common factor among the domineering Sanskritists and Indologists from the British Isle, Max Muller included, was their superiority complex. Under that intoxication they had surmised that if no formalized philosophy and culture existed in Europe during half a millennia BCE, nothing much of value could possibly have existed elsewhere either.

In the above quotation, Pundit Guru Datta Vidyarthi expressed that *in the treatment of a question such as the estimation of the value of a system of philosophy or religion, extreme sobriety and impartiality of the mind are required,* which these scholars lacked. Those Europeans who thought contrary to such Western colleagues and instead praised the wisdom contained in the Vedas and the other Vedic texts were critically put down, more so by Max Muller himself than the others. Hence, this author chose Max Muller and his work on Vedic Literature as a contextual reference-sample to set the record straight.

With limited depth in Vedic philosophy and a poor grasp of the vast Vedic Literature in Sanskrit language, the Western scholars built theories on the meaning of Veda mantras, some out of ignorance and others with prejudice-laced ulterior motives. The fact remains that the ancient Vedic Literature is vast and is the product of the most sophisticated advanced Sanskrit grammar with uniquely rich Vedic terminology. To grasp all disciplines covered in the Vedas and the Vedic Literature, a student was generally required to study full-time in a *guru-kula*.

A *guru-kula* is a centre for learning (an ashram) where resident students become part of a guru's family, begin their education under the direct tutelage of the guru and leave the *guru-kula* after completing higher

education. A student could return home after specializing in a specific discipline of Vedic education. However, to complete an extended syllabus on higher education, he/she was required to stay in the *guru-kula* for at least two decades away from home and under the direct guidance of a resident learned guru. In contrast with the solid grounding in the Vedas and the Darshans in *guru-kula* was the limited semester-tutelage in a modern university.

Guru Datta Vidyarthi noticed that in addition to having inadequate preparation in Sanskrit grammar the writings of Indologists were thronged with pre-conceived notions and prejudices. He also noticed that they had either ignorance of the preexisting well-defined Vedic methodology prescribed by the *rishis* (sages, philosophers, ascetics, thinkers) for understanding the mantras or they had complete disregard for it. The prescribed methodology for translating, interpreting and understanding a mantra has existed from ancient times, has never been a hidden secret and is readily available for those sincerely looking for it. However, to benefit from this ancient methodology one had to, before attempting to translate even a single mantra, bring oneself to a required level in Vedic learning. This straightforward methodology required thorough knowledge of the books of Brahmanas (first interpretive commentaries on Veda mantras), Upanishads, Smritis, Darshans (philosophies), Nighantu (specific dictionary of Vedic terminology), Nirukt (Vedic analytical etymology) and Sanskrit *vyakaran* (grammar) which includes the 'science of word formation' and the 'science of sentence structure'. Swami Dayanand Saraswati in his translations of the RigVeda and the YajurVeda in the Hindi language had emphasized frequently that one should not even think of translating a Veda mantra without having pre-knowledge of these subjects. As mentioned before, he highly recommended one to study Nirukt, authored by Rishi Yask and Ashtaddhyaayi Grammar, written by the great grammarian Rishi Paanini. The literary scholars estimate that Rishi Yask lived before 1900 BCE and Rishi Paanini lived before 2707 BCE (ref. "Aryon ka Aadi Desh aur Unki Sabhyata", p.12, by Swami Vidyanand Sarasvati, 1989, "Vedant Darshan ka Itihaas", Ch. 3, by Acharya Udayaveer Shastri).

Max Muller was among several Western Sanskritists and Indologists who translated the RigVeda and numerous other Vedic and Buddhist texts from Sanskrit to English. The West considered him an authority in the Sanskrit language and his word on the Indian culture, language and history

was considered final. All this he mustered up right in England without ever setting foot in India. If he had desired he could have personally observed and experienced the traditional Vedic teaching and learning process that had helped the *rishis* and philosophers to flourish in India. Several Vedic learning centers were still prevalent in British India.

Guru Datta Vidyarthi in his writings in English cited the English translations of the Veda mantras from Max Muller's RigVeda translation and pointed out the errors in the word-meanings and the misunderstandings of definitions and concepts of the Vedic terms (see "The Terminology of the Vedas and European Scholars", 1888 CE cited above). Many of these active Western scholars had read Guru Datta's writings, understood the problem, and developed a better understanding of the Vedic Literature. Unfortunately, several authors among the most known and respected Indologists and Sanskritists of that period (19$^{th}$ and 20$^{th}$ century) had already produced and published a large amount of literature that they could not retract without self-defamation and loss of high academic positions at their institutions.

To publish on Indology was an easy route for some in the race to 'publish for immortality' and hold high academic positions in their universities. They observed the prevailing religious practices of the Hindu society that were a derivative of the inferior education system adversely affected by centuries of the Muslim rule. This was the period when following the rituals blindly and worshipping multitudes of gods and goddesses with varied images and forms were the norm. Compounding the problem further were the readily available ritualistically slanted translations and commentaries of Vedic texts by the contemporary Indian pundits such as Raavana, Mahidhara (1589 CE), and Sayana (14$^{th}$ century CE).

After the revival of the Vedas by Swami Dayanand Sarasvati during the last part of the nineteenth century, with his strong message to the Hindus for shunning rituals and blind beliefs, there has been a gradual change among the Hindus of independent India. He travelled extensively covering a large part of India, preaching and pointing out the ills of the Hindu society, the ills of the misinterpretation of the Vedas by Puranik writers, including the deficiency in the translations and commentaries on the Vedas by Indian pundits. In his criticism, he did not spare the Western scholars, who were busy publishing misleading books on the Vedic wisdom. Citing Veda mantras, he emphasized that there is only one God in the Vedas and Vedic philosophy and that the Vedas are the books of knowledge

unaffected by time and locale. There are no rituals in the Vedas and there is no social history in them. For the enriched Vedic history, one had to look into the rest of the Vedic Literature. Recognizing the urgency for the Hindu society to 'go back to the Vedas' he established a society in 1875 CE named Arya Samaj. In addition to creating an awareness of the Vedas in the Hindu society, an aim of the Arya Samaj has been to bring back the *guru-kula* education system and establish colleges with emphasis on the Vedas and the Vedic Literature in their curriculum. The Arya Samaj has since produced great scholars, philosophers and writers, including Pundit Guru Datta Vidyarthi.

The translation and interpretation of Vedic references presented in this book are based on the context and meaning of each word, without interpretive bias. The freshness in a Vedic thought is owing to the time-independent universality in Vedic thought and not owing to choosing the relevant English terminology. The reader will hopefully derive increased pleasure from this book and get intellectual benefit when he or she accepts that any principle with latent truth in it remains invariant with time, even when the language and the culture of a society go through changes. *So is it with Vedic philosophy* - to borrow the concluding sentence from Pundit Guru Datta Vidyarthi's quotation. Based on the standard that Guru Datta set, it is imperative for this author, as well as for anyone else, to make a sincere attempt for rising to an *exalted mental condition* to *comprehend* the meaning of the Veda mantras and then account effectively to share the knowledge with the eager and unbiased reader.

Generally, no one has difficulty in accepting that the Vedas and the Vedic Literature are very ancient. The difficulty however arises when a specific date or a period is assigned to the age of the Vedas and the Vedic Literature. With direct research in ancient Indian literature and history, the thinking about the ancientness of the Indian civilization and Vedic Literature is slowly changing for the better. However, the absurd theories of the Indologists are like cleavers, difficult to shake off once they cling. The European authors using mainly the Contemporarian Method, attempted to fix the dates and the succession period of the main Sanskrit texts of antiquity. The religious prejudice blatantly expressed by some Western Indologists did not help the situation. Guru Datta in his book, 'The Terminology of the Vedas and European Scholars' remarked,

"*Various professors have fruitlessly tried to fix dates of these writings by searching in them, in most cases in vain, for any well-known historical facts…..our modern professors of Sanskrit should* (may) *have forgotten the invaluable maxim that nearer we approximate to the Literature of the period to which the Vedas belong for their interpretation, the greater would be our chances of the interpretation, being more probable and more correct*".

Some Western Indologists genuinely fascinated with the ancient wisdom of India devoted their entire life to understand it, yet they erroneously thought that the literature and the history of the Indian civilization could not be older than a thousand years BCE. Evident from the DNA studies of the Indian population presented towards the end of the Chapter 3 is that the same Indian gene pool has existed on the Indian sub-continent since the Holocene geological epoch exceeding 10,000 - 15,000 years in the past, going into the Pleistocene epoch extending from 12,000 years to 2.5 million years. Therefore the Vedas, Vedic Literature and their creativity ought to be extremely ancient. A glimpse of the vast Vedic Literature is in the following and some important Vedic terms are explained.

## Vedic Trayi-vidya: Tri-knowledge

The Aryans have considered that the Vedas have been in existence from the beginning of their civilization for which a time-marker is difficult to assign. Most books of Sanskrit Literature contain, in one form or the other, the references of the Vedas but the references of other books are not in the Vedas. Therefore, it remains indeterminate as to how much development in language and grammar went on before the compilation of the Vedas in their final form. The Vedas are the source of the present Sanskrit grammar and the science of word formation. A remarkable feature of the Vedas, accepted by most scholarly, is that there has not been any change in them since they were first composed. No change of a mantra or a word in the mantra not even a syllable in a mantra has occurred since they were handed down first in some unknown ancient times in the Vedic

Civilization. Therefore, the invariance of the final form of the four Vedas is a phenomenon in itself.

The Aryans of India, now addressed as the Hindus, continue to have high reverence for the Vedas despite the fact that the majority of the present-day Hindus are ritualistic and far removed from the core Vedic principles and Vedic philosophy. Nevertheless, they largely accept that the Vedas are the basis for the Hinduism and are the books of divine knowledge.

It is always said that the Vedas are the books of knowledge but what is this knowledge that the Aryans talk so much about? The starting point for the answer to this question is in the RigVeda, the first of the four Vedas. The RigVeda states that the Vedic knowledge is *tisrovachah* (RigVeda Samhita, 1/10/1/1), meaning that the Vedas contain ***trayi-vidya*** (*trai* or *tistro*: tri-knowledge). Shatpath-Brahmana (10/4/2/21-22) metaphorically stated –

"*The Creator saw that all forms of matter (bhootas), all forms of energies (all chhandas, stomas, all praanaas and devas) and the consciousness with virtue of amrit* (the property of non-dying, eternal) *are all included in trayi-vidyay. He desired that all forms of matter forming the universe, which is my body, be within trayi-vidyay*."

This includes knowledge in three realms of creation - what is manifest, what is recondite and what is spiritual (or metaphysical). All Veda mantras with differing *chhandas* (metered poetry) reveal knowledge in one of these three realms. The proper Vedic terms for the mantras that belong to these three realms are said to be - *pratyaksh-krita*, *paroksh-krita* and *addhyaatmik*. They respectively mean - *one that is observable*, *one that is there but not seen* and *one that relates to spirituality*. In the Vedas and the Vedic philosophy, a number of correlated triplets within these realms of creation are also well recognized. A few examples of these triplets will make this point clear.

The knowledge of the universe that a conscious being desires and acquires comes from three different realms of creation. This knowledge-triplet in three realms of creation is *adhibhautik, adhidaivik* and *adhyaatmik*. Each term is a conjugation of two terms with the common prefix conjugate being *adhi* to each suffix conjugate *bhautik, daivik* and *aatmik* that represent three realms of creation. The closest translation of

these full conjugations in the context of knowledge is – *adhibhautik:* '*pertaining to the physical universe*', *adhidaivik:* '*pertaining to the visible and invisible forces and systems of nature that help sustain the created universe and affect life of living-beings*' and *adhyaatmik*: '*pertaining to the individual consciousness and the universal consciousness*'. A simplification of the three definitions could be - pertaining to the natural, pertaining to the super-natural and pertaining to the spiritual; covering all knowledge-realms in the created universe. The emphasis in this book is only on the two realms of knowledge – *adhibhautik* (pertaining to the physical universe) and *adhidaivik* (pertaining to the visible and invisible forces and systems of nature that help sustain the created universe). The latter includes the knowledge of Vedic Cosmology with major components of the inanimate creation being the physical forces, energy fields and matter on the one hand and the metaphysical forces operating to sustain the animate creation. Modern cosmology has attempted to address the *adhibhautik* aspect (pertaining to physics) of the creation of the universe. Since there is no getting away from the fact that life and consciousness are intertwined, the phenomena that relate to the conscious-beings, which also relate to the Anthropic Principle in modern cosmology, should be looked at from all three aspects of creation *adhibhautik, adhidaivik* and *adhyaatmik*. A unique perspective of the *adhyaatmik* consideration to the Anthropic Principle in modern cosmology is the subject for another book.

The next triplet associated with the Vedic knowledge is *gyan, karma* and *upaasana* that lead to salvation for eternal bliss - the ultimate aim of a conscious-being soul. These three respectively are to 'acquire knowledge (reducing ignorance)', to 'do right karma while in a physical existence' and to 'develop self-realization to uplift the soul'.

Each Veda mantra relates to knowledge in one, two or all three realms of *adhibhautik, adhidaivik* and *adhyaatmik*. This is the Vedic *trayi-vidya*, the triplet of knowledge. No Veda mantra is meaningless. It is the richness of the Vedic Sanskrit terminology in the inspired mind of a brilliant *rishi* that enables him/her to bring together the right words formulating a mantra in one of the unique Vedic meters. As mentioned earlier, the meaning of a Vedic Sanskrit term reflects the meaning of its root from which the other related words also originate. A single word on the other hand may have meanings that apply in three realms. The context determines what meaning should prevail.

According to the Vedas, three eternal entities coexist: *Paramatman-Prakriti-Aatman*, each component of the triplet having different functions, virtues and properties. They respectively are Creator-Nature-Souls. The inert *Prakriti* (Nature), the material-cause of the universe in corpuscular form at its fundamental level, is composed of triplets of fundamental particles. Serving as the building blocks of the universe (Nature), the three kinds of fundamental particles are *satah-rajah-tamah*; each component of the triplet has a different nature, different function and different properties.

The separation between the components of the Vedic triplet, Creator-Nature-Souls, raises a question - owing to their distinct properties if the three entities of the Vedic triplet are different from each other, where does the well-talked-about Hindu philosophy of non-duality, called the '*Advaita* Philosophy' fit in? As mentioned in Chapter 3 the *Advaita* Philosophy practiced today was introduced in 494 BCE by the 15-year-old extremely brilliant Aadi Shankaracharya. While writing the commentary on Rishi Vedvyas' Vedanta Sutra he introduced the *Advaita* Philosophy according to which everything in the universe is God (Creator), the visible matter of the universe is only an illusion and all conscious-being souls are small quanta of God. As opposed to this theistic pantheism of non-duality is the preexisting Vedic '*Trait* Philosophy' based on the eternal existence of three separate entities; Creator, Nature and Souls. The *Prakriti*-entity (Nature) in the Vedas and in the six Vedic Darshans (philosophies), including the last Sutra known as the Vedanta Sutra, is real, inert and an entity without illusion. It is merely an ingredient necessary for creating the matter and energy forming the universe. It is a separate entity from the Creator and the Souls. In addition, the souls are all separate individual quanta of consciousness, non-convertible into God or matter. The Creator for the Vedas is a conterminous unitary entity with the virtues of formlessness, all-pervading consciousness, non-convertible to matter, non-breakable into souls and so on.

Based on his theistic *Advaita* Philosophy of non-duality Aadi Shankaracharya challenged the philosophers of atheistic Buddhism for public debates and defeated them every time. Crisscrossing India for about ten years, Aadi Shankaracharya preached against the then prevalent Buddhism, practically wiping it out from the Indian society. Both, the *Advaita* Philosophy of Shankaracharya and the *Trait* Philosophy of the Vedic religion continues in the Indian society.

The rishis, ascetics and philosophers in the Vedic discipline pondered over the Veda mantras and created vast post-Veda literature in Sanskrit. They extracted the hidden knowledge in the mantras and presented it in simpler expression for the benefit of most in the Vedic society. This literary work in Sanskrit falls under the general heading of Vedic Literature because, the knowledge base in it is the Vedas and the subjects expounded in it are extensions and interpretations of otherwise concise Veda mantra formulations. The Vedic Literature is grouped under different literary sub-headings.

Without providing the names of all the books in a category, the broad categories of Vedic Literature are listed in the Table 4.1. This includes the works of ancient rishis yet this list is by no means complete. A tremendous amount of Vedic Literature exists in the form of translations and interpretive commentaries on the Vedas by the *rishis*, *acharyas* (authority on Vedic subject) and pundits, which are also an integral part of the Vedic Literature.

Even though the emphasis of this author in building the story of the Vedic Cosmology has been to refer to the Veda mantras, numerous relevant references from these categories are also drawn. Since some of the categories overlapped, the listed categories are in broad chronological order only.

All these books of the vast Vedic Literature are in the Sanskrit language. Because this author has referred to numerous books from these categories, a brief background of each category is presented below.

**Table 4.1: Categories of Vedic Literature. Numbers in brackets represent the number of books in the same category written by different authors.**

| | Category Name (No. of Books) | Name of Book | Comments |
|---|---|---|---|
| 1 | Vedas (4) | (1)RigVeda, (2)YajurVeda (3)SaamVeda, (4)AtharvaVeda | All four referred to in this book |
| 2 | Brahmanas (4) | (1)Etreya, (2)Shatpath, (3)Saam (Tandya), (4) Gopatha | Other additional Brahmanas not listed here. (1) and (2) referred in this book |
| 3 | Upvedas (4) | (1)AyurVeda, (2)DhanurVeda, | One upveda for each Veda |

| | | | |
|---|---|---|---|
| | | **(3)GandharvaVeda, (4)ArthaVeda** | **respectively** |
| **4** | **Smritis (28)** | **Manusmriti + 27 other, too many to name here** | **Manu-Smriti referenced extensively in this book** |
| **5** | **Ramayan (1)** | **Ramayan** | **Biography of Ram by Rishi Valmiki: History, philosophy, referred in this book** |
| **6** | **Upanishads (10) and Aranyakas** | **Too many to name here** | **Written by different *rishis,* some references used** |
| **7** | **Vedangas (6)** | **(1) Shiksha,(2) Kalpa, (3)Vyakaran, (4) Nirukt,(5)Chhanda, (6) Jyotisha** | **Many sutras on each. The (4) referred extensively in this book** |
| **8** | **Darshans (6)** | **Details in Table 4.2** | **Referred frequently in this book** |
| **9** | **Mahabharata (Bhagvadgita)** | **Book of Mahabharata, Bhagvadgita part of Mahabharata** | **By Vedvyas and his disciples,history, philosophy, referred in this book** |
| **10** | **[Puranas (18)]** | **Too many to name here** | **History, mythology** |

# The Vedas

The names of the four Vedas, mentioned in the first chapter, are Rik, Yajuh, Saam and Atharva. Following the conjugation rule in Sanskrit grammar called *sandhi*, these four terms conjugate with the suffix term '*veda*' yielding the names Rigveda, Yajurveda, Saamveda and Atharvaveda. The spelling and the sound of the individual words under the euphonic fusion of words according to the Sanskrit *sanddhi* rule are primarily preserved with minor change in spelling and sound at the fusion-point. This author has capitalized the letter 'v' in the term *veda* throughout this book for their names to read: RigVeda, YajurVeda, SaamVeda and AtharvaVeda.

Although there is strong connectivity between the preceding and succeeding Vedas, each Veda emphasizes a specific realm of knowledge. Thus, the RigVeda is for *gjyaan* where the term *gjyaan* stands for knowledge. YajurVeda is for *karma* where the *karma* stands for action, SaamVeda is for *upaasna,* where *upaasna* means '*that which brings one closer to the Creator*' and the AtharvaVeda is for *vigjaan* (*vi-gjyan = specific-knowledge*) which means science and applied knowledge.

## The Meaning of the term "veda"

To know the meaning of the term *veda* itself one has to know about how the word formation takes place in the Sanskrit language. Without going into the details of this ancient science of word formation, a limited background is presented here. A reader may find this interesting and even enlightening. This author however deems it essential to present it here because throughout the framework of this book the mantra translations would often require the analysis of Vedic terms, particularly the analysis of word formation in Vedic science and cosmology.

A word in Sanskrit language originates from its *dhatu*. A *dhatu* is an independent meaningful entity by itself with properties. A *dhatu* generally is a smallest meaningful word from which originate many words which are related in their meanings. A *dhatu* can be as small as a single letter of the alphabet. Alternately expressed, a *dhatu* is a generative for words originating from it and all these words reflect the basic properties of the *dhatu*. All *dhatus* in Sanskrit language are generative of all the words that exist in this language. Thus, all individual *dhatus* together are the

'powerhouse' of word formation. There is no arbitrary or ad hoc creation of a word in Sanskrit.

A literary meaning of the term *dhatu* is also 'root'. Just as the single main root of a tree generates many branches in the tree, all having a dependent relationship with the same root, a single *dhatu* (root of words) generates many words. In Sanskrit, there are 1967 basic *dhatus* to form all words. In addition, the multiple *dhatus* forming single words further enrich the Sanskrit vocabulary. When a single word is formed from more than one *dhatu*, the word reflects the properties of each *dhatu* in it. Therefore, the foundation for word formation in Sanskrit is built on a methodology that is scientific and therefore is invariant and non-degenerative with time. Unlike many languages of the present societies, Sanskrit is more than a mere medium for expressing the meaning of the learnt words. The development of the process of word formation in Sanskrit from a generative *dhatu* (root) so early in the human history is by itself an incredible invention by the ancient Vedic *rishis*. When one examines a word in Sanskrit one goes to its *dhatu* to determine its meaning.

After creating a large number of words, a single *dhatu* in itself continues to be an un-enervating fountain of words. This is why a primary letter (syllable) of the Sanskrit script is termed as *akshara*, meaning '*the one that does not decay*', out of which the *dhatus* are formed. All words formed out of a *dhatu* are all linked to the parent *dhatu* and to each other through branching chains. With this brief background on word formation in Sanskrit let us now bring in the definition of the term *veda*.

The *dhatu* named *'vid gjyane'* in association with the *ghang pratyaya* forms the word '*veda'*. The *'vid gjyane' dhatu* is for creating words that relate to knowledge and the *ghang pratyaya* specifies the meanings such as 'an entity' or 'an action' or 'an enabler'. Therefore, *pratyaya* is that which enables the identity of the item for which it stands. This *dhatu* and this *pratyaya* together yield meanings of the term '*veda'* such as the 'knowledge', the 'substance of knowledge' and the 'instrument of knowledge'. After the Mahabharata War ended in 3140 BCE, the Sanskrit language started to decline. To put the declining Sanskrit language on the right track the great Sanskrit grammarian Rishi Paanini wrote the book of Sanskrit grammar, "Ashtadhyayi Sutra", with full analysis of *dhatu* and word formation. Estimates based on recent research in Vedic Literature and history suggests that Rishi Paanini lived a few centuries after Mahabharata.

According to a prominent contemporary scholar of Sanskrit, Swami Vidyanand Sarasvati, the period of Rishi Paanini is estimated to be 2707 BCE. Rishi Paanini in his Ashtadhyayi (meaning – 'Eight-Chaptered Book') has related the *vid dhatu* to *satta, laabh* and *vichaarne,* which respectively are the reality of creation (existence), enlightenment and knowledge. These in conjunction with the above *pratyayas* determine the word *veda* to encompass knowledge of the Creator, knowledge of the creation, knowledge of the created substances. The last one is the enlightenment that one gets by understanding the nature of Nature and the nature of Nature's byproducts. When simply put, the implicit meaning of the term *veda*, derived from the above deeper analysis, is '*revelation of knowledge*'.

When one steps back for a moment and thinks about the effect of the above word-analysis on one's mind, it quickly becomes obvious that the formation of the word *veda* and its meaning creates an abstract picture that is comprehensible by the mind only (no other knowledge senses needed). There is nothing concrete in this abstract picture that could activate some of the five knowledge senses. There was nothing in this exposé for the eyes to see or the other senses to hear, smell, taste or feel. All five knowledge senses in this exercise remained completely passive and inoperative. When the meaning of the term conveys an abstract picture, comprehensible by the mind only, such a meaning is said to be *yaugik*, a term introduced earlier in Chapter 1. When one moves down on the word generative chain of a *dhatu* from the *yaugik* meaning of a word that is closest to its *dhatu* to other words on the same chain with ordinary meaning representing a tangible substance or an object, such a meaning is said to be *rudhi* (ordinary) meaning. Therefore, a *rudhi* meaning (the ordinary meaning) of the word *veda* translates to mean '*the book of knowledge'*. However, its *dhatu* being *'vid gjyane'* it still relates to knowledge. A book is a substantive object that one is able to see, feel, smell and even taste; thus tickling the knowledge senses.

With this quick exposé on how the words in Sanskrit language are formed and what they mean where and when, the reader certainly would appreciate that the Sanskrit language trains all mental faculties of a human being and exploits his/her full knowledge-spectrum. The reader would also understand why there is emphasis in Vedic studies for one to recognize and differentiate the application of the word with respect to a context. The context generally is either *yaugik* with extraordinary meaning closest to its

*dhatu* or *rudhi* meaning relating to a concrete object. All words and terms in Veda mantras represent *yaugik* meaning and not the *rudhi* meaning. This fact escaped the Western Indologists and Sanskritists who translated the Vedas with *rudhi* meanings of the Vedic terms and were oblivious to the significance of context when interpreting Veda mantras.

With reference to the term *pratyaya*, mentioned above, the three items, 'an entity' or 'an action' or 'an enabler' that relate to the root of the word *veda,* have strong association with the subjects of the four Vedas. The reader by now may have gathered that there is no room for the obvious superficial meaning for terms in the Vedic Sanskrit. To glean and understand the meaning hidden in a Veda mantra, one has to transform oneself mentally to rise from an ordinary frame of mind to a higher frame - from the ordinary *rudhi* level to the *yaugik*, where a higher level of abstract thinking is necessary.

## *Yaugik* (root-based) versus *Rudhi* (colloquial) Translation of Mantras

In the context of the mantra translation and interpretation of the Vedic terms, the usage of the two important terms introduced here, *yaugik* and *rudhi*, will frequently occur throughout this book. A brief elaboration on these two terms is in order.

In the Table 4.1, the Nirukt authored by Rishi Yask is listed under the Vedangas (item 7). Nirukt Sutra's importance was briefly emphasized in the first chapter as well. Nirukt renders the etymology of the Vedic terms and methodology for the Veda mantra translation and interpretation. While the study of Nirukt is essential for understanding the methodology for mantra interpretation and analytical etymology of Vedic terms, Nighantu, the ancient dictionary of specific Vedic terms is essential for developing the knowledge of Vedic terminology itself. Nirukt is a minimum prerequisite for understanding the hidden meaning in a mantra. The scholarly in Sanskrit Literature estimate that Rishi Yask's book of Nirukt that deals with the analysis of specific terms in specific mantras was written sometime about two millennia BCE.

Rishi Yask in Nirukt's first chapter has effectively emphasized that the terms used in the Vedas are *yaugik* (possessing derived meaning) as opposed to *rudhi* (terms having conventional or concrete meaning). When

Pundit Guru Datta Vidyarthi expressed his concern about the consistent usage of *rudhi* meanings of the Vedic terms by the European scholars while translating the Vedas into English and other European languages, he defined these terms aptly in "The Terminology of the Vedas and European Scholars (1888 CE)".

***Yaugik*:** *A term that has a derivative meaning, that is, one that only signifies the meaning of the term's root together with the modifications affected by the affixes. A yaugik word is purely connotative.*

***Rudhi*:** *A term that is the name of a concrete object, where the connotation of the word gives no clue to the object denoted by the word. It means a word of arbitrary significance.*

These two definitions state that a *yaugik* meaning is the fundamental meaning that is closest to the root representing the property of the root and a *rudhi* meaning is the ordinary meaning that conveys the name and definition of a concrete object and is usually in common usage. Since the society functions with the usage of words under both definitions, one has to apply the right meaning in the right context.

Unfortunately, most translations of the Veda mantras by Indian pundits with Puranik emphasis and those produced by the Indologists and Sanskritists of the 18th and 19th century, are based on the *rudhi* meaning of Vedic terms. This has resulted in the translations of the Veda mantras that exhibit little knowledge content in them and are mostly nonsensical. This has also resulted in the misunderstanding about the Vedas, demeaned the high level of intellect of the *rishis* and therefore misled even the intellectuals who had no opportunity to study the Vedas.

A Veda mantra is a compact twine of knowledge, language and grammar. For this compact formulation the great philosopher Rishi Kanaad stated in his Vaisheshik Darshan (Vaisheshik Philosophy, in item 8 of the Table 4.1 and item 2 in the Table 4.2 to follow), that:

बुद्धिपूर्वा वाक्यकृतिर्वेदे ।

"*Buddhi poorva vaakyakritirvede*."

Vaisheshik, 6/1/1)

**Sutra Translation**:

*"The statements in the Veda are sound intellectual creation"*. (Vaisheshik, 6/1/1)

A relevant part from a statement in Mundak Upanishad (item 6 in Table 4.1) cited below emphasized that the four Vedas are the source of all *aparaa*-knowledge that conscious-beings acquire from creation,

तत्रापरा ऋग्वेदो यजुर्वेदः सामवेदोऽथर्ववेदः …..

(Mundak Upanishad 1/5)

"*Tatraaparaa rigvedo yajurvedah saamvedo-atharvavedah*…."

**Translation**

"*Of the two kinds of knowledge (paraa and aparaa), the four Vedas – RigVeda, YajurVeda, SaamVeda, AtharvaVeda and their six Vedangas are the source of all aparaa-knowledge…."* (Mundak Upanishad 1/5).

The *paraa*-knowledge pertains to the Creator. It is acquired by the yoga practice and not just by the study of the Vedas and the Vedangas. The nature of the Vedic poetry is beautifully expressed in the 32nd mantra in the 8th section of AtharvaVeda's 10th chapter.

अन्ति सन्तं नजहात्यन्ति सन्तं नपश्यति ।
देवस्य पश्य काव्यं न ममार न जीर्यति ॥(AtharvaVeda,10/8/32)

**Transliteration:**

"Anti santam na jahaatyanti santam na pashyati.
Devasya pashya kaavyam na mamaar na jeeryati."

**Mantra Translation**:

*"Creator's ubiquity is perpetual and yet He is unobservable. O man! Observe the poetry (Veda) of such a Deva and have revelation of its nature. It neither withers nor does it enervate*." (AtharvaVeda, 10/8/32).

To experience the invariance of the thought and the meaning in a Vedic mantra one has to have a deep knowledge of Vedic Sanskrit or have at least its *yaugik* translation in the right context, the context that is always prescribed by the *rishi* who had the revelation of the mantra. The methodology of understanding a mantra is as scientific as the methodologies evolved in modern science for understanding the result of the study of a physical phenomenon.

One always needs a language to express a thought. To express a phenomenon or a study one evolves a methodology and then ultimately resorts to a language and terminology relevant to the phenomenon or the study. Depending on the development of relevant terminology in that language, the final deduction could be verbose and descriptive or it could just be a concise definition or a formulation. For example, the terms 'spin' and 'orbit' are used to represent the Earth's 'repeated rotation around its axis' and its 'repeated revolution around the Sun'. To express a thought or a deduction in appropriate terminology in a compact formulation is the ultimate desire of an intellectual. A Veda mantra is such a formulation.

Let us take a simple example of the graphical representation of the growth of a tree with time. It required developing a methodology first which included the accurate measurement of the tree-height at regular time intervals, preparation of a data table with columns of two variables (tree-height and time) and then the plotting of a graph to delineate the growth of the tree. The final step in the methodology is to derive from all data points on the graph a mathematical relationship between the two variables. This mathematical relationship is the mantra for the growth of the tree. Recorded at different times each data point is independent of all other data points on the graph, yet when viewed in a relationship, which is the graph, each data point relates to all the other points on the graph.

In the same way, all the terms that formulate a Veda mantra relate to all the other terms in that mantra. The difference between the two formulations however is that while the formulation and ensuing conclusion on the tree growth will not change significantly if one data point was taken out. In the case of a Vedic mantra, not even a syllable could be taken out, because doing so would disturb its meter and alter its meaning as well. Therefore, a mantra formulation is in the framework of a methodology that in some ways is more scientific than the theoretical science methodology with unreal hypotheses. Sanskrit, the scientific language, takes the methodology

in the direction of perfection. Just as arbitrariness in science methodology is a no-no, arbitrariness of word formation, as in some other languages, is absent in Sanskrit. Let us discuss a bit how terminology becomes part of an expression and then revisit the meaning of the term *veda* from a different perspective.

The theme of this book is cosmology, which is science. This book has drawn references from the Vedas where the thought process revealed in the form of mantras should indicate to us whether it is scientific or not. No one disagrees with the facts that the Sanskrit language is ancient, its structure complex, with a scientific method for new word formation, developed in India and is a marvelous invention of high order by the *rishis* in India's far antiquity. In the modern era when scientists create new science terminology, at times it is arbitrary and sacrifices logic or departs from scientific reasoning. Alternatively, words are borrowed from the Greek and Latin lexicons. Consequently the scientific terminology right now is a mixed bag of terms that had originated in Latin, Greek, other European languages, English and new English. The result is that a single scientific term may not necessarily convey the intended meaning. It may become necessary to fall back on the field of verbose sentences to understand the term's true meaning. There is nothing wrong in that, however, to express a full sentence by a few meaningful words certainly shows the advancement from simple to sophistication. Brevity is natural to science because mathematics is one of its tools. Nevertheless, assigning scientific nomenclature to substances or to a phenomena in modern science has to invoke the prevailing language of the society where a root (or roots) to create an appropriate word may or may not be available. Then forming a term out of already existing words is the appropriate second choice. An example of this in modern cosmology is the term 'black hole', coined in 1967 by the famous American physicist John Wheeler, who also coined the term 'space-time'. The term 'black hole' has come very close to what it is intended for, however, not quite completely.

A black hole is a most dense astronomical object, to the extent that nothing, not even light, can escape its extremely high gravitational attraction. Around a black hole is a mathematically defined surface called the 'event horizon' (coined by the physicist Wolfgang Rindler) such that the matter and the radiation (light) going past a black hole are completely pulled in by it without reflecting. It is black because no light or any form of

radiation is emitted by it and no light falling on it is reflected from it (it seems there are departures to this conclusion). It is a hole because things fall in a hole and do not return. Hence the name 'black hole'!

The analysis of the term would indicate that the term 'black hole' could just be a misnomer. A hole in a substance, by definition, is the space devoid of that substance. The reverse is the situation in a black hole where, owing to its tremendous gravitational attraction, it carries highly packed matter everywhere in it than in its surroundings. There are no holes in a black hole and if there were any, they will fill first by the matter falling into them. A black hole in fact creates a hole in the space around and outside it, which is not an actual part of it. Therefore, this scientific name of "black hole" for a solid spherical cosmological object with extremely high matter density in it is a misnomer and strictly speaking should have been something else! Not familiar with the terms in cosmology, a person coming across the term 'black hole' has to read at least a paragraph to understand what it is. In the process, he also has to understand what 'space-time' and 'event horizon' are. Such a salmagundi is practically non-existent in Sanskrit nomenclature. I am sure other Sanskrit scholars could come up with a more fitting term from the Sanskrit nomenclature for a black hole, however, this author can think of a quick meaningful term for it. Just call it "*bhootbhakshak*"! This term is a conjugate of two terms, *bhoot* and *bhakshak*, which respectively mean – 'matter devourer'. Matter and radiation being *bhoot* in Sanskrit, the *bhootbakshak* is not a misnomer. To reflect the property of black hole being devoid of light as well, one could even call it, '*tamah bhootbhakshak*! It will become obvious from the forthcoming mantra references that the Vedic Sanskrit is extremely rich in scientific terminology. This richness is without borrowing a single term from other languages and without any other language influencing it and permits amazing brevity of expression.

The simple logic therefore should prevail that if scientific terminology existed in the Vedas it could not have been purposeless – there must be science in the Veda mantras. Yes, there is, plenty of it! It is incomprehensible to think that the *rishis* of the Veda were able to invent a language with a structure that is logical and scientific with rich science terminology but did not have any scientific ideas in them! As stated above, the subject matter of the AtharvaVeda is *vigjyan*; the common meaning of it being 'science', there must be some science in it! This book is a limited

effort in extracting that science out of the mantras from the four Vedas and from the Vedic Literature created subsequently in the ancient times of the Vedic civilization. However, to evince further the scientific nature of the Sanskrit language, a few more words about *dhatu* are in order here.

## Sanskrit: A Language with the Scientific Structure

Linguists and philologists have presumably written at length in different languages on the logical and complex structure of the Sanskrit language. This author briefly presents in the following some features of Sanskrit from a physicist's perspective. The purpose of this exercise is to delineate the similarity between the organization of the Sanskrit language by the Vedic *rishis* on the one hand and the development of methodologies to organize inventions and discoveries by contemporary scientists on the other; both methodologies aimed at the enhancement and dissemination of knowledge. As mentioned above, the term *dhatu* in the context of language stands for the 'root of a word'; all words generated from a *dhatu* must reflect that *dhatu's* properties. Language being an expression of the abstract, the term *dhatu* stands for a non-subsistent entity, which is the source of words and compound words that are also non-subsistent in nature. When one moves from the arena of Sanskrit language to the Vedic science arena of *rasaayan* (chemistry), the term *dhatu* also stands as a generic term for subsistent elements – hydrogen, oxygen, iron, copper and all the rest of the elements because out of an element are created a large number of chemical compounds. Thus, just as a *dhatu* (element) is the root-cause of all its chemical compounds, a *dhatu* (in language) is the source of words that originate out of it following the rules of Sanskrit grammar.

Just as the meanings of all Sanskrit words originating from a specific *dhatu* reflect the basic meaning of that *dhatu*, the physical and chemical properties of chemical compounds originating from a specific element are owing to that element (*dhatu*). The interesting similarity between Sanskrit and modern science is that there is similarity in fashioning the terminology in both. A basic difference between modern science and Sanskrit is that while an individual element in modern science is recognized by a specific term (name) which differentiates it from the rest, a *dhatu* (element) in Sanskrit may have a number of synonyms as well. The synonyms represent

different properties of the same entity. Aryans from ancient times have had terms of many elements (*dhatus*) in physics/chemistry and many other inorganic and organic substances that are mentioned in the Veda mantras. There is even instruction by the Vedas to find these substances by excavating the mountains, hills and the ground in general. In one YajurVeda mantra (18/13) alone there are several *dhatus* (elements of chemistry) listed and also listed are other substances namely – stone, *mrittika* (clay), sand, wood, vegetation, precious elements/substances, blue-sapphire and other crystals, iron, gold, lead, tin and so on. The mantra instructs to excavate these useful substances for mutual benefit.

As an example, the Vedic terminology for some substantive *dhatus* (elements) taken from the AtharvaVeda (11/3/7, 8) and presented here in the table. Their corresponding common names in English are furnished in the second column. These elements are well-known as the '*dhatus* of *rasaayana*' (elements of chemistry). The usage of the same term *dhatu* in both arenas – for a substance in science and for word formation in language, is scientific. An element is the starting point for all chemical compounds produced by that element. Likewise, in Sanskrit a *dhatu* is the starting seed for a word in the language.

A science student in the modern day chemistry class learns that there are altogether 98 naturally occurring elements in Nature, beginning with the lightest first element Hydrogen (H) with atomic number 1 to Californium (Cf) with atomic number 98. The well-known radioactive Uranium (U) has the atomic number 92. About 20 more beyond the 98 elements have been artificially synthesized in the laboratory.

| **Sanskrit** | **English** |
|---|---|
| *Ayaha, loham* | iron |
| *Taamram, lohitam* | copper |
| *Trapu* | tin |
| *Seesam* | lead |
| *rasah, paarad* | mercury |
| *Rajatam* | silver |
| *hiranyam, haritam, suvarn* | gold |

To recognize one from the other, each element is assigned a symbol formed out of one or two first letters in its common name with the first letter capitalized. This symbol is the formula for that element, as C is for Carbon and Cu is for Copper. All elements are arranged in a tabular form called the 'periodic table'. Russian chemistry professor Dmitri Ivanovich Mendeleev is credited for organizing the elements in a periodic table first in 1869 CE. He placed all the elements in the ascending order of their atomic numbers, leaving gaps for atomic numbers for elements that had not been discovered by then. By observing the periodic trend and similarity in their properties, he placed them in rows and columns. It is interesting to note that a German chemist Julius Lothar Meyer also independently published his periodic table in 1870 CE and he also arranged elements in the same manner as Mendeleev did. Both, Mendeleev and Meyer coming up independently about the same time in two different locales with the same optimal arrangement of elements, which still stands today, is a reality. Two minds arriving at a single finality may be rare but is also a reality in Nature.

The minds of *rishis* eons ago arriving at a finality about discovering the *dhatus* (elements) of Sanskrit language is not a coincidence either, it is also a reality. Just as all the 98 elements of the periodic table form all chemical compounds in the universe and create the universe itself, in Sanskrit language the 1967 basic *dhatus* in Sanskrit language, extracted from the Vedas, create all primary words in the Sanskrit language. The development of Sanskrit with a *dhatu*-system and the development of methodology in modern science with an arrangement of elements in a periodic table are two scientific phenomena with the commonality in the method that took place independently, eons apart. The Sanskrit term *dhatu* having the same meaning as the term 'element' is not a coincidence or a chance factor. It had to happen because that was the highest level of development that the two scientific systems were to reach. There is a striking parallelism between the structures of both, the modern science methodology and the methodology in the Sanskrit language. A simple example in the following should demonstrate this commonality between modern science and Sanskrit.

Two *dhatus* (elements), C (Carbon) and H (Hydrogen) are chosen here to form several organic compounds. The following list includes just a few from a large number of organic compounds formed by Carbon and

Hydrogen atoms with one or two C atoms and two and more H atoms in their formula. The chemical name of the compound is in the bracket.

$CH_4$ (Methane), $C_2H_2$ (Ethyne), $C_2H_4$ (Ethene or Ethylene), $C_2H_6$ (Ethane), …

Notice that the names of these compounds have common sounds with only minor variations. In the same manner if one chooses a *dhatu* from the Sanskrit language, one could represent all the words originating from that *dhatu* in a manner quite similar to the above example from chemistry. Our basic subject being 'knowledge' let us take the example of a root (*dhatu*) that generates a large number of words that relate to 'knowledge'. The root reflects its basic meaning and exhibits its presence in all the words that it generates; something similar to C in all organic compounds listed above. This particular entity in our example is the single syllable alphabet of Sanskrit script, ज्ञ, pronounced as *gjya* (each English letter g, j, y pronounced together). It generates a large number of Sanskrit words; only a limited number of short words generated from ज्ञ (*gjya*) are listed in the following. The English meaning of the word is also given.

ज्ञ (*gjya*) = knowing, ज्ञ: (*gjyah*) = an intellectual person, ज्ञा (*gjyaa)* = to learn, to know, to perceive, .., ज्ञप्ति (*gj*yapti) = understanding, .., ज्ञान (*gjyaan)* = knowledge, ज्ञात (*gjyaat)* = known, comprehended, understood,.., ज्ञातृ (*gjyaatri)*= a known person, an acquaintance, ज्ञात्रा (*gjyaatraa*) = one who knows, ज्ञाता (*gjyaataa*)= *one who has full knowledge of*,.., प्रज्ञा (*pragyja)* = intellect, सर्वज्ञ (*sarvagjya*) = omniscient, all-knowing ….,

The list of words, originating from ज्ञ (*gjya*), goes on. This abridged list of words from one single letter ज्ञ is astounding!

From the example of the letter ज्ञ (*gjya*) creating meaningful Sanskrit nomenclature with a large number of words, one observes that there does not appear to be room in the methodology for much further improvement. We are led to accept the fact that the thought process of the Vedic *rishis* was scientific, final and remarkable. Their thought discipline for organizing their discovered knowledge for the maximum benefit to the society through

developing the language in prose and poetry was excellent. It is amazing that all this took place in the distant past of the Vedic Civilization.

To keep words compact is another attribute of Sanskrit. Notice that in the above example a single letter ज्ञ (*gjya*) needed four English alphabets to write it: g, j, y, a. In addition, as listed above, the abridged list of words originating from ज्ञ shows that up until about a dozen words from it the words did not exceed two Sanskrit alphabets. Even when a word originating from ज्ञ becomes long, it continues to show the presence of ज्ञ in it and continues to project its basic meaning related to 'knowledge' in all words formed by ज्ञ. As soon as a word is pronounced, the sequential phonetics of the utilized alphabets in the word tells the meaning of that word. A total of 63 alphabets in Sanskrit script with their specific sounds create an immense field of expression. Most of the alphabets in Sanskrit are single syllable letters. Those interested in a glimpse into the development of these Sanskrit alphabets, that took place in the distant past, should look into the 'Varnochharan Shiksha' written by Swami Dayanand Sarasvati, cited a number of times. The meaning of the title of his book "Varnochharan Shiksha" is - "Education of Letter Pronunciation". Thus, the antiquity should not be seen as the cause for devaluation of the wisdom of the *rishis* who invented Sanskrit and wrote mantras in it in compact formulations with metered poetry, the poetry that is unique in itself. The beauty of the 'knowledge' is that it is ever youthful.

The word represents the name of an object, a phenomenon or a process. Therefore, the name must reveal the properties of whatever it stands for. Just as a *dhatu* generates numerous words, an object owing to its numerous properties would have numerous Sanskrit names as well, each name originating from the same or a different *dhatu*. The Sun and the Earth are good examples for this. This author has collected about 20 synonyms of the Sun and 33 for the Earth, tabulated in Chapter 11 in Volume 2.

Although a mantra will express exactly what it intends to convey, the right meaning of the mantra can be extracted only when the right context of the mantra is kept in mind. Additionally, the right linguistic tools are to be used to extract the right meaning from a mantra. Any adamancy on the part of a scholar to translate a mantra without the full grasp of the Sanskrit methodology would not be short of literary subversion. Professor Max Muller in this author's opinion is responsible for the greater part of this

literary subversion. With time, this subversion led to the disrespect for Vedic thought. This disrespect started primarily in the 19th century when Sanskritists and Indologists insolently took it upon themselves to teach Indians how to write their own history and how to interpret the Vedic scriptures. Swami Dayanand Sarasvati objected to this. He strongly emphasized that one should go closer in time to the Vedas, as far as possible, to look for the meaning of even a single word in a mantra and study its usage in other mantras to understand the context and the application of its meaning. Then one could look for its interpretation in the Brahmanas, Smritis, Upanishads and Yask Rishi's Nirukt and Nighantu rather than looking into the recent interpretations of Mahidhara (1589 CE) and Sayana (14th CE).

It seems that Max Muller et al. did not come across the *nyaaya* (Vedic Logic System) phraseology of *'sthool rundhati-nyaaya'*, which means - "*As an object is approached closer and closer its true knowledge becomes closer to certitude*".

First thing that comes to mind on reading the principle of *'sthool rundhati-nyaaya'* is that the principle may apply only to *sthool* objects where the term *sthool* stands for an observable solid substance having form with dimensions. However, the principle is general and is equally applicable to the *sthool* as well as to the abstract; the latter could be a formless thought contained in a literary work. To understand better what a *rishi* in a Veda mantra might have meant and intended one should go as close as possible to the time of the formulation of the mantra. The best way to achieve this with a high degree of success is to look into the interpretation and commentary of the mantra in the ancient Vedic texts, as old as possible. The Brahmana books and Nirukt are these old resources.

Pundit Guru Datta Vidyarthi in his writings in the late 19th century had expressed it as the maxim for the then modern professors of Sanskrit and the Indologists. He put it in English write-up to alert the modern professors and Indologists of his time:

> *"The Nirukt even lays down explicit rules on the terminology of the Vedas which are as yet, quite unheeded by the modern professors. Niruktkara* (creator of Nirukt, Rishi Yask)*, in the very beginning of his book, forcibly inculcates that the terms used in the Vedas are yaugik (possessing derived meaning) as contrasted with rudhi (terms having*

*conventional, arbitrary or concrete meaning)"*. (Guru Datta Vidyarthi in "The Terminology of the Vedas and European Scholars", 1888 CE)

The Puranik scholars like Sayanacharya, Mahidhara and Ravana carried out translations with *rudhi* meanings of Vedic terms and therefore portrayed the Vedas as having human history, mythology and worship of multiple gods and goddesses, while the Vedas have none of these but have only pure knowledge. Most Western Indologists and Sanskritists such as H. H. Wilson (1786-1860), Max Muller (1823-1900), Monier-Williams (1819-1899), Macdonell (1854–1930) and several more also produced in English the *rudhi* translations of the Veda mantras. The scholars who carried out research in the Vedic Literature generally follow these authors and produced dissertations with erroneous conclusions.

## Yaugik to Rudhi Sequence

Being a physicist and a beneficiary of the valuable Vedic Literature, this author intends to give the reader an exposé of the dimensions that exist in the Sanskrit language. This is being done in a physicist's perspective rather than in a linguist's perspective. An understanding of these dimensions will help reveal the true meaning of the terms in the Veda mantras, specially the terms of physics and cosmology that have frequented the mantras and the *sutras*. This author has taken utmost care to follow the Vedic methodology to formulate the Vedic Cosmology Principle in Chapter 6 and to develop the Vedic Cosmology Scenario in Chapters 7 to 10. To exemplify that a single object may have a large number of synonyms and a single term (word) can yield a number of meanings, the author has chosen commonly used Vedic terms representing different meanings in different contexts, ranging from the *yaugik* meaning signifying its root, to the *rudhi* meaning signifying the name of a concrete object. This author has chosen two *yaugik* Vedic terms that exhibit how their status leads to their *rudhi* residuum. These terms are *sarasvati* and *Ayodhya*. These terms are of great significance pertaining to the history of the Vedic Civilization and the geography of the nation of Aryavart (India's ancient name) discussed in Chapter 3. Let us first take up the term *sarasvati*.

## Analysis of the term '*sarasvati'*

The term *sarasvati* has already appeared in Chapters 1 and 3 and in this text a number of times in Swami Dayanand Sarasvati's name. This term in a name represents an honor given to a monk with high intellect who has mastery over the language and grammar and who devotes his time in learning, teaching and the dissemination of Vedic knowledge. Therefore, an immediate impression of the term *sarasvati* is that it relates to knowledge. The knowledge is something that is real in existence and abstract in nature. The term *sarasvati* has appeared numerous times in the Vedas wherein all terms are *yaugik*, representing the root meaning of the term. The term *sarasvati* in *rudhi* usage appears in the post-Veda ancient Sanskrit Literature for the name of a mighty river. However, Sarasvati being a river, a physical entity, the meaning of the term '*sarasvati*' here is *rudhi*. All Vedic terms being *yaugik,* the term *sarasvati* in the Vedas must mean something else.

The great Sanskrit grammarian Swami Dayanand Sarasvati has analyzed the term *sarasvati* and emphasized that the term *sarasvati* in the Vedas carries the *yaugik* meaning.

Sarasvati in the Puranik (mythological) sense is the goddess of learning, creativity and wisdom. Pursuit of knowledge being the theme here the term '*sarasvati'* still conveys the *yaugik* meaning. However, when the Puranik mythology depicts the image of the goddess Sarasvati as a female with four arms enthroned on a white swan, the meaning of the term *sarasvati* is *rudhi* and is exterior to the Vedas. Whether the *yaugik* meaning applied to the formless God in the Veda or the *rudhi* meaning applied to the Goddess with form in Puranik mythology one thing is certain that the word '*sarasvati'* relates to the knowledge and spirituality.

The *yaugik* Vedic term *sarasvati*, according to the interpretation given in the ancient book of Nirukt, is for God. With regard to the word-formation from the root (*dhatu*), the term *sarasvati* is derived from the root *sri gatau* (the dynamic action) to yield the term *saras* and suffixes *vat* and *i* added to it (*saras-vat-i*). While defining the virtue-based 100 names of God, Swami Dayanand Sarasvati in the first chapter of his voluminous book Satyarth Prakash, has included *sarasvati* as one of God's names. He defines it thus:

सरो विविधं ज्ञानं विद्यते यस्यां चित्तौ सा सरस्वती ।

"*Saro vividham gjyaanam vidyate yasyaam chittau sa sarasvati*."

This translates into :

"*God's name is sarasvati because God possesses all diverse knowledge with details of words, meanings, word-associations and usage that form speech in humans*".

In the Vedic thought, all knowledge emanates from God, it is received by the minds of living-beings and transformed into speech for dissemination.

When one moves from its metaphysical meaning to its physical meaning, the term *sarasvati* stands for *vani* or speech or the vibrations that convey knowledge. In Nirukt (2/7/1, Nighantu, 11/22), the term *sarasvati* is listed as one among the 57 synonyms of *vani* (speech). Therefore, *sarasvati* in *yaugik* meaning is primarily for 'word' or for 'speech' through which knowledge is transmitted. The term *sarasvati* appears early in the RigVeda in three mantras of the third *sukta* of the first *mandala* (RigVeda, 1/3/10-12). The 12th mantra from that set is presented here:

महो अर्ण: सरस्वती प्रचेतयति केतुना ।

धियो विश्वा वि राजति ॥ (RigVeda, 1/3/12)

**Transliteration:**

"*Maho arnah sarasvati prachetayati ketuna*.
*Dhiyo vishvaa vi raajati*."

Based on Nirukt's etymological definition of the term *sarasvati* meaning 'speech', Swami Dayanand Sarasvati has provided interpretive commentary on this mantra and its translation in the Hindi language. This author's English translation of the same is given below. Before he furnished the mantra translation, the added comment made by Swami Dayanand is that this mantra has *vachkopmey-luptopma-alankara*, which means that the poetry of this mantra has a specific literary adornment in a decorative simile. The English translation of his Hindi translation of the mantra is:

"*Just as the ocean's greatness is enhanced by the wind creating waves on its surface and by the Sun illuminating its vastness, revealing*

*its precious contents and its usefulness, the Space (carrier of vibrations) and the Ved-vaani (voice,vibrations, knowledge) together illuminate the ocean of Vedic vocabulary. This is then transmitted through the voice (sarasvati) of the scholarly, enabling the elevation of the intellect in ordinary people*." (RigVeda, 1/3/12)

Swami Dayanand, while translating the three RigVeda mantras (1/3/10-12) in his RigVeda translation, commented on the translations of the same mantras by the 14th century pundit, Acharya Sayana and the Indologist Professor H. H. Wilson (1786-1860), a contemporary of Swami Dayanand. Swami Dayanand with his detailed translation pointed out that there is no Vedic basis in these mantras for Acharya Sayana and Professor Wilson to imagine a female figure of goddess Sarasvati having a mortal body with four arms and riding on a swan or of a physical river Sarasvati. This nineteenth century monk Swami Dayanand a great scholar of Sanskrit and the Vedas, was straightforward in his conclusion - "*those who are inspired to translate or interpret a book of knowledge without knowledge are no different from those suffering from visual impairment"*. (see RigVeda Bhasya-interpretation of the mantra (1/3/12) by Swami Dayanand Sarasvati).

The *sukta* (hymn) 61 of Chapter 6 of RigVeda (6/61/1-14) has 14 mantras in it whose *devata* (subject) is *sarasvati*. All these mantras relate to the human intellect and the human voice. The human voice, among 13 *karans* (vital functions of the mind) of the Vedic philosophy, is one of the instruments of the human mind that the mind uses to convey a thought by creating sound vibrations. This *sukta* may have been the basis for the ritualistic worship of the goddess *Sarasvati* revered as being able to bless her worshipper with a beautiful voice for singing. The *yaugik* meaning of the term *sarasvati* thus applies primarily to God, knowledge and the voice through which God-given knowledge disseminates.

The *yaugik* meaning of the word *sarasvati* also appears in the RigVeda mantra (9/5/8) where it is not related to a river or to a goddess with four arms. There are three *yaugik* terms used for 'knowledge' in this mantra. Because the knowledge is the 'cause' and the speech its 'effect', the three Vedic terms for knowledge are naturally related to each other. These terms are - *bharati, sarasvati* and *ila,* which stand for three distinct qualities of the human intellect-entity, the Sanskrit term for which is *Buddhi* (see Nirukt

also). As discussed earlier, a single Vedic term may stand for entities with similar virtues, in the spiritual realm the word *sarasvati* stands for the Omniscient universal spirit and it stands for the *buddhi*-element (intellect) in the physical realm. At a *rudhi* level, it stands for the River Sarasvati, a goddess with image or just any female with that given name.

The term *bharati* represents '*bibharttiti bhartastsyeyam bharati*' – '*the intellect for developing knowledge in the subject of Bhramn (God)*', the term *sarasvati* represents – '*intellect for developing diverse knowledge*' and the term *ila* is for – '*applied intellect that is revered and praised by all*'. This mantra creates a visualization in the human mind that the three 'rivers of intellect', originating from the Brahmn (the Creator) flow on the plane of the *Buddhi*-element (Intellect-element) of a living-being. Metaphorically, these three types of intellect are tributaries of the single river called 'knowledge', which in the Vedic thought is considered to be emanating from the creator Brahmn.

Two *suktas* of RigVeda (7/95/1-6 and 7/96/1-6), with six mantras in each, are important where according to Swami Dayanand's interpretation based on Nirukt and Nighantu, the *sarasvati* of the mantras is not a physical River Sarasvati. These mantras have 'decorative simile' to describe the meaning of the word *sarasvati* and when *yaugik* and *yoga-rudhi* meanings of the word, as emphasized by Nirukt are considered, its meaning is - सरो ज्ञानं विद्यते यस्या असौ सरस्वती । (*saro gjyanam vidyate yasya asau sarasvati*). This translates into - '*The one who possesses knowledge is called sarasvati*', as in the name of the great scholars like Swami Dayanand Sarasvati.

The answer to the question – how did the extinct mighty river get its name Sarasvati – lies in the *sukta* 75 of RigVeda's chapter 10 wherein the Veda teaches people how to name their rivers (RigVeda, 10/75/1-9). The *sukta* has provided 37 river-names with specific characteristics found in rivers. The ancient *rishis* learned from the Veda that if the river has the characteristic of सारांसि संति यस्या सा सरस्वती (*saaraansi santi yasya sa sarasvati*) which means '*the one which is formed by many tributaries*' and represents the *sri gatau dhatu* for tremendous motion (flow) call that river Sarasvati. Thus, whereas the *yaugik* meaning of the word *sarasvati* relates to knowledge, which purifies the inner conscience of a being, the *rudhi* meaning of the word *sarasvati* is for a dynamic river (Sarasvati) which

enables the purification of the physical exterior of a being. The scriptures have emphasized that much Vedic knowledge has been developed on the shores of the mighty River Sarasvati.

In the perspective of the spiritual realm, the knowledge flows from the Omniscient Brahmn, reaches the sea of living-beings who are enriched by the tributaries of constantly flowing knowledge from all directions of the creation, thus enhancing the magnificence of the river of knowledge. The benefits of the physical river Sarasvati also have been enormous for the Aryans of the antiquity, making it a part of the river-system, which by definition would be a *devata*. A *devata* is the one who possesses brilliant properties, be it a conscious being or an inert entity of nature (a river), selflessly providing benefit for others in the *yajna* (selfless act) of sustaining life in the creation. Any other interpretation of *sarasvati* would be due to the confusion between a simile and a reality.

When viewed in a localized perspective the flow of knowledge into a conscious being is from the five realms of knowledge-senses culminating into a single Intellect-entity of the person. This is like the five tributaries forming a stupendous river. Therefore, the *rishis* of the ancient times found an immense river on the Indian continent with five tributaries and named it Sarasvati. The naming of the river Sarasvati (*rudhi* usage) is thus an after-effect of the mantras enabling appropriate vocabulary. The *yaugik* usage of the term *sarasvati* in the mantras however has much deeper meaning.

The aim of this discussion was to point out the methodology for extracting the meaning hidden in the mantra by using the *yaugik* meaning of the terms forming the mantra. The mantra always has a deeper meaning and purpose, to enlighten a person, rather than communicating some ordinary matters. Whereas the *yaugik* meaning of the terms is necessary in a mantra, one finds the application of *yauga-rudhi* and *rudhi* words for the names of substances. Just as the water in a river flows from a higher level towards the lower level, the meaning of the words flows from the high *yaugik* level to *yauga-rudhi* to *rudhi* level. Just as the reversing of the flow of a river can bring disaster, bringing the lower level *rudhi* meanings of words used in ordinary life into Veda mantra interpretation, would bring undesirable results!

## Analysis of the term Ayodhya

Now let us take up the *yaugik* meaning of the term '***ayodhya***' that appears in AtharvaVeda (10/2/31) and the *rudhi* meaning associated with a concrete object/entity in daily life.

It has been customary in most civilizations to choose a name from the vocabulary already present in the scriptures that they follow. In the distant past of the Vedic Civilization, the great King Manu of Aryavart (ancient name of India) established a city for his kingdom and named it Ayodhya, the meaning of the term *ayodhya* being '*non-conquerable*', certainly a decorous name for a capital. Manu's city of Ayodhya continues to exist even today as one of the oldest cities, in the Uttar Pradesh state of India. The term *ayodhya* in the AtharvaVeda mantra (10/2/31) relates to the living human body and not a city. The meaning of the mantra is – "*…this human body is unconquerable (ayodhya), a perfect dwelling for the living functions and the place of the soul illuminated by Brahmn* (Creator)*"*. The reference to *ayodhya* in this mantra is for the remarkable human body well protected against outside attacks from diseases. Based on the term *ayodhya* in this mantra some scholars concluded that the AtharvaVeda was written after King Manu established the city of Ayodhya. Since Manu's Manusmriti is based on the Vedic knowledge and is suffused with the references of the Veda mantras, it would be right to say that Manu chose a meaningful pre-existing term from a mantra to name his city Ayodhya. Thus, the usage of the term *ayodhya* in the Veda mantra is *yaugik* and its usage in the name of a city, a concrete entity, is *rudhi*.

The ancient *rishis* have endorsed the fact that the Vedas are the source of all terminology for the human speech that is to be both, learnt and applied. The 'word' is the source of knowledge and it sustains knowledge. In the Vedic tradition, throughout the Vedic Literature down to Nirukt and Nighantu, it has been emphasized that the purpose of the Vedas providing rich terminology is to help the humans to develop knowledge and to apply that knowledge for successful functioning in their lives and society.

The Veda has provided rich terminology in a large number of areas of human endeavour. The terminology relates to the external world, the human body and the healthy functioning of its external as well as internal organs. As an example, one mantra of the AtharvaVeda (2/33/3) names several important internal body organs and functions: *hridaya* (heart), *klomn*

(lungs), *haleekshn* (pancreas), *pleennh* (spleen), *yakn or yakrit* (liver). Knowing that the two human lungs are dissimilar in size (left lung being smaller) the *rishis* did not use the general term *klomn* for both. The Veda and the other *Ayurvedic* treatises address them with the separate names, the left addressed as *haleekshn* and the right as *Klom*.

The term *hridaya* (*hri +da + ya*) for 'heart' is analyzed elsewhere in this book showing that the term *hridaya* is formed out of three different *dhatus* that create three actions that manifest heart's complete function. The first syllable ***hri*** is for ***harati*** to take, the syllable ***da*** is for ***dadati*** to give and ***ya*** for ***yati*** to keep going. It is the blood that it takes in, gives out and keeps pumping. Based on the Veda mantras, the comprehensive Vedic science of medicine has been developed and preserved in the treatises under the subject of *Ayurveda* (Science of Aging) which in the Vedic Literature is included under the Upveda (item 3 in Table 4.1). Providing details on *Ayurveda* science is beyond the scope of this book. For more insight in this area, the reader is advised to look into the AtharvaVeda. The Veda mantras furnish a large number of terms for the organs and functions of the human body. The Veda also mentions over a hundred medicinal plants for specific cures.

Examples of the enriched terminology in the Vedas for the benefit of the society, particularly in the area of physical sciences, were mentioned in the Chapter 1 citing the AtharvaVeda's (19/7/1-5) *Nakshatra Sukta* giving 28 meaningful terms to name the constellations in a sequence that is still in use in the practical astronomy of today.

The rivers have played an important role in the society. The rivers and river-systems flow selflessly for the benefit of the society and help sustain societies. Therefore, the Vedas have put the rivers under the designation of a *devata*, namely the *Naddyah Devata*. The fact that the River Ganga is Ganga and the River Yamuna is Yamuna from their respective sources at Gangotri and Yamunotri in the high mountain regions of the Himalayas all the way until the end goes to show that the Aryans had a very good final consensus in the way they named their rivers. The basis for a consensus was already provided in the RigVeda mantras (10/75/1-9) where the naming of the rivers according to their features and characteristics was advised and to name a river the Aryans just had to look that river template up. Since the Vedas were acceptable to all Aryans as the divine inspiration, following the

wise advice of the *rishis* was an easy choice to build consensus in naming the rivers.

If the invading Aryans came to India around 1500 BCE, as advocated by Max Muller et al., could they have reached a consensus to name all rivers of the Indian sub-continent and enter 37 river names in RigVeda (10/75/1-9) under the subject (hymn) of *Naddyah Devata*? The *yaugik* terms '*sarasvati'* and '*ayodhya'* in fact pre-existed in the scriptures to represent different contexts from where they were adopted in *rudhi* usage to name two different concrete objects, a river and a city respectively. In the RigVeda's template of 37 river names the river Sindhu means a river '*with high velocity*', the Gange (Ganga) means a river '*going fast*', the Yamuna means a river '*moving in association as well as separately*', Sarasvati means '*with abundance of water and dynamics*' and Drishdvati means '*a river with abundance of stones*'.

The absence of name duplication of rivers and the absence of multiple names of the same river in different regions of the Indian subcontinent indicates that the Vedic methodology of naming the rivers was successful and must have been the result of a concerted effort using the river-name-template provided by Rishi Sindhu-kshitpraiya-medh, of the *Naddyah Devata* sukta of RigVeda. The basis for the implementation of the river-name-template throughout the subcontinent must have been with the sociological approach to the methodology in ecology, with the organized geographic survey of the entire country. Even after such incredible achievements under the conditions of presumably primitive communication system if some Indologists labeled the Aryans of India as 'shepherds' and the Vedas as the 'songs of shepherds', they only proved their mediocrity in scholarship. The singularity in river nomenclature for the rivers of Aryavart indicates that the river names were sorted out in the distant past. This leads to the significant conclusion that the Aryan Civilization is very ancient. The fact that the river Ganga was called Ganga by the time the book of Mahabharata was written over five thousand years ago and the Ganga was Ganga in the book of Ramayana written eons prior to Mahabharata, leads one to conclude that the Aryan Civilization and the Vedas have to be extremely ancient.

## Organizational Structure of the Books of Veda

All mantras in the Vedas are metered poetic phrases grouped in *sukta*s (sections) with each *sukta* containing a number of mantras in it. A number of *sukta*s form a *mandal* or *addhyaaya* (chapter). A *devata* is associated with each *sukta* where the *devata* of the *sukta* is *sukta*'s subject matter. Each mantra has a self-sufficient independent thought in it on the subject (*devata*) of the *sukta*. Yet this subject does not relate to human history or events in the human civilization. Mantra by definition is the one that has knowledge hidden in it to be extracted with proper linguistic tools. A mantra is a unique poetic couplet in a specific meter. In mantra poetry, the meter of a mantra is not determined by the number of words used or by achieving the rhyming between two lines, as is usually in contemporary poetry. The meter of a mantra is determined strictly by the total number of alphabets in all of the words used in the whole mantra. This is the uniqueness of the mantra poetry.

It is relatively easy to compose poetry with two lines in a couplet such that the recitation of each line takes the same time regardless of how many words or syllables were used in each line. It is also relatively easy to write both lines ending with rhyming as well as having equal timing when recited. In a sensible poetic couplet, certain number of words is used but it is not the poet's worry as to how many total number of alphabets are consumed in all the words used. It is however difficult to have a couplet with the desired number of alphabets in all the words in the couplet. The word-count is not essential in mantra poetry as long as all words are *yaugik* and meaningful. It is the total number of alphabets used in all the words that is specific. It is not just one or a few mantras composed with this stringent literary condition but all Veda mantras are composed that way. The mantras in an entire *sukta* may be in the same meter or have mantras in several different specific meters, yet all follow the desired rule. Even highly scholarly Sanskrit pundits of today are unable to create poetry with the restriction of each line of the mantra couplet having the desired number of alphabets. If someone claims to have created a meaningful mantra by following this rule or has created several mantras on a given subject one has to realize that the uniqueness of the Vedic poetry is not limited to a few mantras or a few *suktas*; rather this is on a very large scale. It may be of interest to the reader that the RigVeda alone has 10,521 mantras in it with a total of 153,792 words utilized in them. All mantras are grouped into 1,028

*suktas* with 209 *devatas* (subjects) credited to 354 *rishis*, among whom are 21 *rishikas* (female *rishis*).

The term used in English translation for a *sukta* is 'a Vedic-hymn'. Each *sukta* is a collection of mantras with the same theme. It has a descriptive heading that includes *sukta's rishi*, its *devata, chhanda* type (meter of the mantra), *swara* (musical note) for the mantra to be recited in a monotone as well as several musical notes are marked on the words through the mantra as a vertical bar on top of the word and a horizontal bar under the word. These additional notes are to sing the mantra in a simple melody. As an example, the most recited *gayatri* mantra is presented below with singing notes marked on and under the words by a bar.

In the context of a mantra or a *sukta*, the word *rishi* stands for a sage who is a highly uplifted soul to whom the mantras were revealed in his or her mind. The word *devata* assigned to a *sukta* represents the subject of that *sukta*. Since the Veda mantras deal with a large number of subjects, there are a large number of *devatas* assigned to the *suktas* (hymns). This was misunderstood by Max Muller et al. to deduct that the Vedas worshiped multitudes of gods and goddesses.

The Veda mantras are basically in seven types of *chhandas* (meters). The *yaugik* meaning of the term *chhanda* is 'vibrations', the implicit meaning of which is - 'poetry with periodicity'. Therefore, the word *chhanda* in the present context means the 'meter' of the poetry. The first type of *chhanda* has 24 alphabets of the Sanskrit script. To explain the intricacies of the Vedic poetry the author chose the most-recited *gayatri-mantra* from the RigVeda (3/62/10), written below in one line with musical notes shown. This *gayatri-chhanda* has 10 individual words in it formed out of 24 alphabets of Sanskrit script. The mantra as recited with word conjugation is presented as follows:

तत्स॑वि॒तुर्वरे॑ण्यं॒ भ॑र्गो॑ दे॒वस्य॑ धीमहि। धिय॒ो यो न॑: प्रचो॒दया॑त्॥

(Mantra with word-conjugation)

**Transliteration:**

"*Tatsavitur varenyam bhargo devasya dheemahi / Dhiyo yo nah prachodaraat* ॥"

The significance of the often recited *gayatri* mantra for the Aryans is akin to the often recited Lord's Prayer for the Christians. The mantra

translation reads thus:

> "*O all-illume Creator of the universe, you are our protector and the purifier of our intellects. Invoking you in our intellects we meditate upon you to direct our intellects on the righteous path*" (RigVeda 3/62/10)

When word-conjugation is taken out and the singing notes (vertical and horizontal bars at the words) are dropped, the *gayatri-mantra* can be written with individual words in the same sequence as they appear in the mantra:

तत् सवितुः वरेण्यम् भर्गः देवस्य धीमहि। धियः यः नः प्रचोदयात्॥

(Mantra with word separation: 10 words).

The single vertical long bar after two-thirds of the mantra and two vertical bars at the end of the mantra are equivalent to a comma and a period in a sentence in the English language.

After splitting the individual words into their individual alphabets, one can arrange them sequentially as shown below with each letter/alphabet marked by a numeral,

त1 त्स2 वि3 तु4 र्व्व5 रे6 ण्य7 म्भ8 र्गो9 दे10 व11 स्य12 धी13 म14 हि15 । धि16 यो17 यो18 नः19 प्र20 चो21 द22 या23 त्24॥

(24 letters/syllables)

Compared to the *gayatri-chhanda,* the next *chhanda-meter* called *Ushnik* has 28 alphabets in it. The successive *chhanda-meters* progressively increase in length with a step of four alphabets, going right up to 48 alphabets in a mantra, forming seven types of basic *chhandas*. The names of these *chhanda*-types are given first in two mantras of RigVeda (10/130/4, 5) under the subject heading of *bhavavrittam* (creation of the universe) and then all seven names of the seven types of *chhandas* are listed successively in a single mantra in AtharvaVeda (19/3/21/1). The names of the seven types of *chhandas* sequentially are Gayatri (24), Ushnik (28), Anushtup (32), Brihati (36), Pankti (40), Trishtup (44) and Jagati (48) and the number in the bracket represents the number of alphabets forming the *chhanda* (couplet). This is the concept of 'meter' in the Vedic poetry. It is unique and

difficult to emulate. To create a meaningful poetic couplet using meaningful words that yield specific number of alphabets makes it unique and difficult.

So that we stay strictly in the realm of the *yaugik* interpretation of the mantras and do not go down the path of mistranslation of the Vedic terms in cosmology and physics, it is imperative to develop a little more insight into the framework of Vedic terminology and the historical aspect of Sanskrit and the Vedic Literature.

The Sanskrit vocabulary that exists within the four Vedas is vast. It led to the formalized grammar rules that were later laid down by the ancient *rishis*, which are still followed in the usage of Sanskrit today. As mentioned earlier, it was Rishi Paanini, the author of Ashtadhyayi Grammar Sutra, who formalized the Sanskrit grammar. It may seem odd that the Vedic vocabulary should exist first in the Vedas and then the rules of Sanskrit grammar were organized. This indeed is the situation because the Vedas happen to be the first books of the Sanskrit language and there is no reference or evidence found in the ancient books in Sanskrit Literature that anything else existed before the Vedas. The post-Veda *rishis* and the sages delved deep into the Veda mantras, discovered the roots (*dhatus*) of the words and later laid down the foundation of the Sanskrit grammar.

Now, coming back to the word *devata*, Rishi Yask in his ancient book of Nirukt (1/7) states that *devata* is a general term applied to those substances and entities whose attributes are invoked in a mantra. A *devata* is a real entity, not a god or a goddess of some kind. When a *devata*, a conscious being or an inert entity is invoked in a mantra or in a collection of mantras of a *sukta*, the purpose is to remind the attributes of the *devata* in the minds of the reciter and the listener. The context being very important in Sanskrit the term *devata* in differing contexts stands for different meanings as well.

A *devata* in a social context would include all those conscious-beings who manifest extraordinary qualities and selflessness who have a positive influence in the lives of others. Example of such a *devata* is mother, father and guru. The virtuous souls that have inspired and transformed societies are also termed as *devata*. The Creator in the spiritual context is addressed as *Maha-deva* the *great-deva* or *devata* of all *devatas*. Exterior to the Vedas, the deities in a Hindu temple are also termed as *devatas*. Human nature is to go for simpler practices and beliefs. The Vedas instead arriving at the concept of God that is conterminous, unitary, all-pervading, formless spirit

is at a higher level of thinking. The fact that the Vedas, in most certain terms, propound monotheism in them was hard for Max Muller to digest. In his defense he stated, "*A large number of Vedic hymns are childish in the extreme, tedious, low and commonplace*" ('Chips from a German Workshop', ed.1866, p.27; taken from the introduction to 'Aryon Ka Aadi Desh aur Unki Sabhyata' by Swami Vidyanand Saraswati, publ. 1989 CE). One gathers from Max Muller's translations of the mantras that before embarking upon translating the Vedas, he did not read even the most fundamental guide prescribed for reading, understanding and interpreting the Veda mantras - the Nirukt by Yask Rishi.

The Vedas after being subjected to centuries of sustained literary onslaught have remained an invariant entity, available even today for close examination by those who seek the truth.

# The Branches of Vedic Literature

## Brahmana Books

The first books of Vedic Literature after the four Vedas, are entitled Brahmanas (Item 2 in Table 4.1). As Swami Dayanand Sarasvati explained, the term "*brahman*" for these ancient books is because they provide interpretation of Veda mantras the ultimate source of which is Brahmn the Creator. The term *brahmana* for a person signifies a learned and a scholarly person. A *brahmana* in the prevailing caste-system of present-day India is the one born in the *brahmana* family (upper caste), learned or not. The word *brahmana* is also spelt as *brahman*. To differentiate the brahmana book from brahmana person this author has used the term Brahmana with the capital B for the book and lower case brahmana for the person.

Whereas a Veda mantra conveys knowledge of a subject in a compact word formulation, a corresponding Brahmana being a commentary book on the Veda narrates it with emphasis and elaboration in simpler expression. The Brahmanas were written in prose and not in metered *shloka* or mantra poetry; nevertheless, their text is highly organized, as in a modern textbook, with proper chapters, sections, subsections and the statement numbers. In addition to providing interpretation of the mantras, the Brahmana books

also advise how to recite the mantras and what mantras to use for specific occasions in the spiritual, the intellectual and the social realms. These books have laid down the foundation of the procedures and methodology in the society for charitable acts, celebrations and in general the implementation of mantras in daily life. The Brahmana books use examples, metaphors and similes to simplify mantra's message for the benefit of the common people and collectively the society as a whole.

Primarily there is one Brahmana on each Veda. The Brahmanas respectively for Rig, Yaju, Saam and Atharva Vedas are: (1) Etreya, (2) Shatpath, (3) Saam (Tandya) and (4) Gopath. The additional Brahmana books are Kaushitaki (or Saankhyayan) on RigVeda; Taitteeriya on Krishn-YajurVeda and Jaiminiya, Saam-vidhan; Aarsheya, Mantra, Devataddyaya, Vansh and Samhitopnishad are all on SaamVeda.

The Brahmana books being in prose were vulnerable for insertions by those with ulterior motives to pollute the Vedic Literature, especially after mythological practices became prevalent in the Hindu society. The non-Vedic sects with the emphasis on atheism added to this pollution. The society in general had high reverence for the *rishis* and the literary work that they created. Their literary work was carried forward as a part of the curriculum of the guru-*kulas* where the resident students learned it, recited it and even preserved it in the form of hand-written manuscripts. This process helped carry forward the Vedic text accurately without even a slight change of a syllable. After the Mahabharata War when the social norms and education gradually declined, the ritualism and blind beliefs took hold in the society. It was this dark period when those pundits who wished to grab power and wealth inserted self-serving text and phrases in the Brahmana books. According to Swami Dayanand Sarasvati, such insertions remained unchecked from about a thousand BCE until about 500 ACE. Therefore, while studying a Brahmana book, one uses caution and discrimination to separate the pollution of insertion that usually is glaringly unfitting in the thought process of the original Brahmana phrases.

The term for an insertion in Vedic Literature is '*prakshipt*'. Therefore while reading a book of Brahmana, Manusmriti, Mahabharata or even Bhagvadgita one should look into the scholarly works published in recent times identifying the *prakshipt* parts. The difficulty however continues that on the one hand, the sincere scholars of the Vedas continue to discuss and point out the '*prakshipt*' text in the Brahmanas and in the other books of the

post-Veda Sanskrit Literature and on the other hand, the printers continue to print the texts with *prakshipt* text in them. There is an increasing awareness now of the problem and identification of the inserted literary pollution.
Several references from the Brahmana texts are included in this book, particularly those related to the scientific thoughts. Since the most inserted prakshipt parts in Brahmana relate to the social context, the Brahmana references pertaining to science thought are generally found to be untouched by the prakshipt text (literary pollution).

## Upvedas (Item 3 in Table 4.1)

Upveda, pronounced as oopveda, are the treatises on specific academic subjects derived from each Veda. The AyurVeda is derived from the RigVeda and the AtharvaVeda. The AyurVeda deals with the 'science of aging' or the 'science of living', which extends into the field of Ayurvedic Medicine; prominently practised among the current medical systems in India. The DhanurVeda, the science of archery is under the military. The GandharvaVeda teaches the art of music, other fine arts, and the ArthaVeda deals with the subject of economics and governance.

## Smritis

Smritis (Item 4, Table 4.1) are the books authored by learned individuals at the level of a *rishi*. Of the 28 Smritis the oldest and the most known was authored by Svaayambhuva Manu, a great king of Aryavart. The King Manu and the *shlokas* from his Manusmriti were discussed in Chapter 1 in relation to the time-division and time conversion factors under the sub-heading of 'Age of the Universe'. Manusmriti was extensively referred to in Chapter 3 in relation to geographic definition of Aryavart and the nation-defining mighty river Sarasvati. It is one of the most valued and revered Smritis of the Aryans. Numerous *shlokas* from Manusmriti covering different subjects are still to come in this book.

Manu was a brilliant scholarly king of the ancient Aryavart Empire who established the present Aryan civilization. Rishi Valmiki's epic poetry Ramayan (Item 5 in Table 4.1), written well after Manusmriti, is a biography of King Ram in Manu's dynasty. Manu in his Smriti has called

his nation, Aryavart. The term Aryavart means - '*the place of the Aryans*'. It was discussed in Chapter 3 how Aryavart's name changed from Aryavart to Bharat-varsh (now official name) to Hindustan and to India.

A large part of the ancient Vedic literary work is in poetry. A poetic couplet in the Vedas is addressed as a mantra and a poetic couplet exterior to Vedas is known as a *shloka*. The knowledge content in a mantra by definition is hidden, requiring extraction, while it is quite obvious and straightforward in a *shloka*. The composition of Manusmriti *shlokas* is in a specific meter called *anushtup chhanda* (*anushtup* meter) with a total of 32 alphabets; 16 alphabets in each line. Whereas the four Vedas are in seven basic different *chhandas* mentioned earlier, the entire Manusmriti is in *anushtup chhanda* only. For the easiness of *anushtup* meter the Valmiki Ramyana, Mahabharata, (Bhagvadgita within it) and numerous other books in Vedic Literature are also in *anushtup* couplets.

The preamble *shlokas* of Manusmriti state that the learned Vedic scholars of Manu's time, the *rishis* and the sages, came to Manu to hear his thoughts on various aspects of life. The book of Manusmriti is the compilation of his sermons to the visiting *rishis*. Manusmriti's first chapter starts with the Vedic principle for the creation of the universe, which closely relates to the Creation Principle in RigVeda's $129^{th}$ sukta of its $10^{th}$ chapter. Five of several *shlokas* from the first chapter of Manusmriti dealing with the creation of the universe are included in the Vedic Big Bang Scenario developed in Chapters 6 to 10 in Volume 2 of this book.

Manusmriti's other chapters contain advisement on the knowledge in all aspects of social life. Manu was a follower of the high ideals prescribed for a king by the Vedas. He was a great king and formulated the "Code of Conduct" for the individual and the society as a whole. Therefore, the book of Manusmriti is also known as 'Manu's Ordinance'. The code prescribed by Manu includes the duty of the judiciary under the king and the duty of the individual towards the society. The kings and rulers established their judiciary and the political framework based on Manu's Ordinance. The present Hindu society is based on Manu's code and therefore the Hindus revere Manu as the 'Law-Giver' of the society.

Based on the nature and the ability of a person (not caste), Manu grouped the society into four categories. These categories together are popularly known as Manu's *varna-system*. The four categories of this *varna-system* with their well-defined responsibilities towards the society are

***brahman*** (responsible for learning, teaching and dissemination of knowledge...), ***kshatriya*** (responsible for the protection of society, administration, ruling...), ***vaishya*** (responsible for welfare and growth of society, business, economics...) and ***shudra*** (responsible for providing direct labour for the service to the society...). This division according to him was fluid. The *varna* of a person was determined by a person's ability, nature and orientation. A person born in a ***shudra*** home (service-oriented) could transit into a ***brahman*** *varna* or into any other *varna* and vice-versa. Many *shlokas* make this fact very clear. The system rigidified into the caste-system much later during the past three millennia, otherwise the meaning of the term *varna* is to choose, which gives the freedom to the person for what he/she wants to be.

Manu's thoughts on the *varna*-system stem out of the Veda mantras in which the human body itself, naturally, has these four functions that analogously lead to the four *varnas* in the society in general. Manu derived the *varna*-system from the Vedas where functioning, be it of an individual living body or the society as a whole, depends on four natural divisions and of equal importance. Numerous references within Manusmriti and in the Vedic Literature show that the *varna*-system was never meant to be a rigid system like it is in the present Hindu society. It has turned into a caste-system with higher-caste and lower-caste connotations with little fluidity of movement between the four groups. The *varnas* relate to the human nature and not to the social strata in which a person is born. Without bringing in all the relevant references from the Vedas and other ancient Vedic Literature just two *shlokas* that define the *varna*-system's identity are presented below. These show the true intent of the *rishis* on which Manu based his Code. A *shloka* from Upanishad (item 6 in Table 4.1) states thus:

जन्मना जायते शूद्र: संस्काराद् द्विज उच्यते ।
वेदाभ्यासाद् भवेद् विप्रो ब्रह्म जनाति ब्राह्मण: ।।

(Vajrasuchi Upanishad)

**Transliteration:**

"*Janmna jaayate shoodrah sanskaaraad dvij uchchyate*/*Vedabhayaasaad bhaved vipro brahm janaati braahmanah* ॥"

**Translation** (from Hindi text in Satyarth Prakash):

"*All are **shudra** at birth. By sanskaar (cultivation of refined character) the person is called a **dvij** (reborn in the same life), the person becomes a **vipr** by studying the Vedas and the person becomes a **brahman** by developing knowledge of Brahm (God)*". (Vajrasuchi Upanishad)

Long before this Upanishad *shloka*, Manu's Smriti stated that the basic nature of a person tends to put him/her in a specific *varna*. The relevant *shloka* from Manusmriti is:

शूद्रो ब्राह्मणतामेति ब्राह्मणश्चैति शूद्रताम् ।
क्षत्रियाज्जातमेवं तु विद्याद्वैश्यात्तथैव च ॥

(Manusmriti, 10/65)

**Transliteration:** "*Shoodro braahmantaameti braahmanashchaiti shoodrataam.*

*Kshatriyaajjaatmevam tu vidyaadvaishyat tathaiv cha*."

**Translation:**

"Based on the nature and karma of the person *a **shudra** becomes a **brahman** and a **brahman** becomes a **shudra**. This applies also to a **kshatriya** and a **vaishya***" (Manusmriti, 10/65).

After Manusmriti, even Krishn in Bhagvadgita (18/41) 5,000 years ago upheld Manu's fluid *varna*-system and emphasizes that the *varna* determination should be based on the *nature of the person* (and not on the circumstances of his family).

One observes that the open Western society of today has moved along the lines of Manu's *varna*-system, according to which a person chooses a profession in which the person has developed capabilities. It may sound far-fetched; however, this author observes that the Western society also has the same four divisions with fluidity for people to move from one profession to another. For example, the scholarly professors, scientists, teachers and

intellectuals are *brahmans* (teaching and learning). The president, prime minister, members of parliament, generals, soldiers and police are *kshatriyas* (administration and protection). The bankers, business persons, farmers are *vaishyas* (business, growing crops) and workers, servers, employees of corporations are *shudras* (service-industry). There is no fifth category because if there were one, the Veda and Manu would have included it.

Manu also provides guidance for different realms of a society, so much so that his Manusmriti has served as the foundation for the constitution of the society. Just to mention a few areas, it provides the rules for the division of property, for marriage and choosing the right partner, for the judiciary, for the duties of each of the four phases of human life-span of 100 years and so on. On preventing the inbreeding in the society, recall Manu's advice (3/5) cited in Chapter 3:

> "*For the marriage of a boy the girl should be at least six generations removed from his mother's side and should be completely outside of his father's genealogy*".

Generated in the far antiquity of India this statement relates to the science of genetics and could lead to further genetic research. The statement goes beyond mere observation of the effect of inbreeding; it assigns definite numbers to the phenomenon. Considerable light from the advanced genetic research of today could be shed on the possible significance of the solid numbers prescribed by Manu for the genealogical distances to be maintained between the blood-relatives of a bridegroom and bride-to-be. Why was a boy to avoid marrying a girl within six generations on his mother's side and why to completely avoid marrying a girl from father's genealogy is worth studying. Manu also forbade parents arranging the marriage of their children without the children's consent. He listed eight classes of marriage (Manusmriti, 21/3) of which the *svayam-var* (choosing one's own partner) was the best.

There is no doubt that there are insertions in Manusmriti as well. These *prakshipt shlokas*, lead to misconceptions about Manusmriti's period of writing, its authorship and its reality. Max Muller et al. have gone as far as saying that Manusmriti was a recent development (a few centuries BCE). Since the Indian history during 4-5 centuries BCE is very well known when

there was no king named Manu, Max Muller said that Manu, known as the first king of Aryavart (India), must be an imaginary person. This requires a bit of an exposition.

When the Vedic practices declined over the past two to three thousand years and mythological books (Puranas) of the Hindus were compiled, the caste system rigidified. Some brahman priests with the ulterior motive of promoting their own sect and registering control on the society inserted a large number of *shlokas* in the ancient books including Manusmriti. Some of the inserted *shlokas* diametrically opposed the general thought pattern of Manu. Owing to this literary pollution found in later compilations of the manuscripts of Manusmriti, the authenticity of Manusmriti itself was questioned.

After Swami Dayanand Sarasvati's awakening of the Hindu society in the late nineteenth century and after the Indian independence from the British Raj, scholars carried out considerable research on ancient Vedic Literature, including Manusmriti. These scholars realized the extent of the harm caused by the inserted *shlokas* as well as the harm caused by the distortion in Indian history created by Sanskritists and Indologists of the West. Their research effort identified the inserted *shlokas* and helped the publication of corrected versions of important books, Manusmriti being one. Among others, the effort by Professor (Dr) Surendra Kumar is remarkable. Manusmriti's citation in this book is according to the *shloka* numbering in 'The Vishuddha Manusmriti', an interpretive translation of Manusmriti in Hindi by Professor Surendra Kumar, published by Arsh Sahitya Prachar Trust (January, 1996). The possibility of insertion by literary polluters is minimal to nil in the section pertaining to cosmology in Manusmriti's chapter 1. This author has drawn some deductions on the amazing scientific observations found in Manusmriti. A detailed discussion on this and the historicity of Vedic references is in Chapter 3.

# Ramayan

Rishi Valmiki is the author of Ramayan (item 5 in Table 4.1). Valmiki was a contemporary of the great and ideal king of Aryavart, King Ram (also written as Rama). King Ram was a descendant in King Manu's genealogy. This genealogy is also known as the Solar-Dynasty. Ramayan is Ram's biography written in Sanskrit poetry in *anushtup* meter. Ram's virtues being

extraordinary, the author Valmiki through Ram's biography has provided a beautiful exposition of the desired social ideals, principles, duties and morality. Ramayan is also a window providing a glimpse of the life of the people and the level of civilization during Ram-rajya, a common phrase in the present Hindu society for good governance. Ram's governance was so ideal that all governments in India, past and present, with the exception of the Muslim and the British rules, strove to emulate Ram-raj. Owing to the specific dialect of the author of Ramayan, the meter of the couplets and the *shaili* (grammatical aphorism) of the Sanskrit usage, an astute scholar of Vedic Literature could easily spot an insertion in the Ramayan.

An abridged genealogy is recited in Ramayan's 29th section of its first Chapter covering the kings from Manu until Ram's father, Emperor Dasharath. Rishi Valmiki in this list of kings of the Solar-dynasty has named 34 kings with some anecdotal information on some of the virtuous kings in that line. Ayodhya remained the capital of the Solar-dynasty since Manu established it. Rishi Valmiki describes the metropolis of Ayodhya at the time of Ram's father, Emperor Dashrath. Rishi Valmiki states in Ramayan's Baal-Kaandam (3/1-3),

> "*The geographic region known as Kosal was full of prosperity and wealth with contented citizens. The great king of people, Manu, had established the metropolis of Ayodhya as his capital at the bank of Saryu River. This world-famous metropolis (at the time of Ram) with beautiful wide roads was 12 yojan* (150 km) *long and 3 yojan* (36 km) *wide*". (Valmiki-Ramayan, Baal-Kaandam, 3/1-3).

The Ramayan also states that after Manu established Ayodhya the first king to rule Kosal region was his son Ikshvaku. In Manu's genealogy there was also a great king named Raghu. The same Solar-dynasty ruled from Ayodhya from Raghu to Rama and until Vrihadbal the king of Ayodhya in 3140 BCE. Ram's dynasty is also addressed as Raghu-vansh (Raghu-genealogy). Among other poetries that the great Sanskrit poet Kalidas wrote during the reign of King Vikramaditya; his poetry entitled "Raghu-Vansh", in praise of this dynasty, is considered to be very beautiful and an excellent piece of literary work. Kalidas wrote Raghu-Vansh sometime near 50 BCE when he was a court-poet of the King Vikramaditya who ruled from Ujjain in central India. Vikramaditya is the king after whom the Vikram-*Samvat*

(Calendar) continues in the present Hindu society of India. The onset of Vikram-Calendar is with Vikramaditya's coronation in the month of March, in 57 BCE. The Luni-Solar Vikram-Calendar is prepared based on the indigenous astronomical calculations and printed for the usage of the Hindu society. It includes all the Hindu festivals, the days for fasting, the dates of astronomical conjunction of planets and constellations and the accurate predictions of the solar and lunar eclipses. The Vikram-Calendar's scientific astronomical information has become the bonanza for the non-scientific fatalistic astrology who use the astronomical positions of the planets and the stars for fortune telling; a money making racket in the name of Vedic science.

The Solar-dynasty continued after Ram with his two sons Lav and Kush. Innumerable generations passed in the continuity of this dynasty at Ayodhya. A Puranik account names the King Vrihadabal in Ram's dynasty ruling from Ayodhya during the Mahabharata War (discussed in Chapter 3). Just as in the World War II, most countries of the world had little choice but to join in the war against Germany, so also was the situation in the Mahabharata War. In this Kurukshetra War the king Vrihadabal of Ayodhya chose to fight on the side the righteous Pandavas. The Pandavas were victorious and Yudhishthir was coronated in 3140 BCE.

# Upanishads

The word *upanishad* (item 6 in Table 4.1) is a derivative from three words: *up* (pronounced as *oop*), *ni, seedati*. When put together the meaning of the word *upanishad* is *'one that enables proximity to Brahman the Creator'*. Therefore, Upanishad is a *'medium for attaining eternal bliss'*. There are ten Upanishads that are considered ancient. They are Eesh, Ken, Kath, Prashna, Mundak, Maandukya, Etereye, Taitteeriya, Chhaandogya and Brihadaaranyak. Aadi Shankaracharya (509-477 BCE) in the fifth century BCE wrote commentaries on them. Swami Dayanand Sarasvati declared these ten as the Vedic Upanishads. Upanishads are the Vedic interpretive books that expound philosophical thoughts in the Veda mantras and express them in simpler statements that sometimes are in question-answer form - questions by students and answers given by their *rishi* guru. These Upanishads are non-sectarian and have universality in thoughts and

principles. The books of Aranyakas are also in the same category as the Upanishads.

While writing a recent interpretive commentary on six Upanishads in the Hindi language, Swami Darshananand Sarasvati mentioned in his book 'Upanishad Prakash' that in addition to these 10 Vedic Upanishads there are at least about 240 other non-Vedic sectarian Upanishads that have cropped up since about 500 BCE. Authors belonging to various sects within ritualistic Hinduism and outside of it wrote these additional Upanishads. These so-called Upanishads lack universality of thought and are self-serving. There is even an Upanishad called *Allopnishad* written by a Muslim with Islam as its theme. An Upanishad is to convey universality of thought. If not, it is another book of a religious sect. Therefore, a student of Vedic Literature has to be cautious and knowledgeable to distinguish between the Vedic and non-Vedic Sanskrit Literature.

## Vedangas

The Vedangas (item 7 in Table 4.1) contain six distinct branches of the Vedic Literature that a student of the Vedas is required to master. The six subjects under Vedangas lead a student of the Vedic studies to become a master of (1) the science of morals, (2) the science of dharma (3) the science of language, (4) the science of etymology, (5) the science of poetry and (6) the applied science from geology to astronomy. Researching these and commenting on them is beyond the scope of this book. During the Vedic studies a student learns about the practical methodologies such as writing and recording mantras and manuscripts, grounding in grammar (study of Ashtaddhyayi), Nirukt (e.g. Yask Rishi's Nirukt) for etymology and interpretation of Vedic terminology and the exposition to the knowledge in Vedic poetry for word meaning and accent. Through the six Vedic Darshans (philosophies), the student is educated in the logic system, yoga practice, the nature of matter and substances, the observational and mathematical astronomy, and many other subjects. To complete the Vedic syllabus that covers these branches of Vedangas, a student would devote his entire student career at a *guru-kula* (guru-family). There have been many well-known *guru-kulas* in ancient India and there are those established in recent times owing to the inspiration of Swami Dayanand Sarasvati. These

education centres are dedicated to teaching Vedic Literature and ancient cultural traditions of the Aryans.

A student who has taken a crash course in Sanskrit, without a solid grounding in Sanskrit grammar and etymology cannot do justice when interpreting Vedic Literature. A solid grounding in Vedic learning is achieved by increased contact with the guru, which was the practice in the ancient *guru-kula* system.

# Darshans

The six Darshans (item 8, Table 4.1) are listed in the Table 4.2. All six Darshans separately deal with six differing knowledge realms of Vedic philosophy. They are also popularly known as the Shastras or the Sutras. These six Darshans are addressed as Vedic Darshans to differentiate them from the Jain and Buddhist Darshans.

Some people thought that since the Darshans propound six different schools of philosophy, they were contradictory to each other. This is not the case because they all have their foundations in the Vedas where there are no contradictions. All six Darshans are in fact complementary to each other covering six different realms of the creation with a fair bit of overlap. The Darshans are not in poetic form; they are in the form of short statements called the sutras. A sutra is an aphorism with the formulation of a single thought and principle. It is therefore a formula. The ordinary meaning of the word sutra is 'thread'. All sutras of a Darshan are connected together to form the philosophy of that Darshan. In other words, all principles of the philosophy expounded in that Darshan are threaded together. There are frequent references of the Darshans in this book. A Darshan expounds its subject matter completely from the beginning to the end and therefore the short comments under the 'Subjects' column of Table 4.2 provide only a glimpse into the contextual background of this book.

**Table 4.2: Six Vedic Darshans**

| | Darshan | Rishi-Author | Subjects |
|---|---|---|---|
| 1 | Nyaaya | Gautam | Examination by logic and proof. Cause-Effect in Creation. Logic and Capitulation, Logical fallacies…. |

| | | | |
|---|---|---|---|
| 2 | Vaisheshik | Kanaad | Physical nature of the Universe (molecules, atoms,..), Time dependence of Action, nature of cause and effect….. |
| 3 | Saankhya | Kapil | Deals with Purush (Creator, Paramatma), Atma (Soul) and Prakriti (Nature/matter), Creation of the Universe, its primordial byproducts, functions and their relationship to living beings, Sukshm-Shareer (minute body) and connection between the matter, soul and consciousness…. |
| 4 | Yoga | Patanjali | Treaties on Yoga (very popular in the West) |
| 5 | Poorv-Meemansa | Jaimini | Importance of karma (Jaimini was Rishi Vedvyas' student) |
| 6 | Uttar-Meemansa | Vedvyas | Brahm (The Creator). Other names of this Darshan are: Brahm-Sutra, Vedanta-Sutra and Shaareerik-Sutra |

The six Darshans are placed in chronological sequence in Table 4.2 that is based on the scholarly discussions found in the Vedic Literature. The traditional Indian Vedic scholars have placed them in a sequence based on historical accounts in Sanskrit Literature and on their references found in other Vedic books.

Some Vedic scholars may not agree with this chronology; however, most would accept that the first four Darshans are anterior to the Mahabharata and the last two successively written by the two rishis definitely were contemporaneous to Mahabharata. All scholars agree that the last two are in the same chronological order as in Table 4.2. Without going

into the details of all the reasons, a brief commentary on why they are placed in the chronological order of the Table 4.2 is given below.

Nyaaya Darshan (item 1 in Table 4.2) deals with the origin of logic as the cognitive ability of human beings. Its author Rishi Gautam in his very first sutra (aphorism) lists 15 essentials for acquiring true knowledge. This list starts with the word *pramaan*, the meaning of which is, 'means of getting true knowledge' and does not start with the word *atha* in its first *sutra* as the other five Darshans do. The word *atha* stands for 'now let us discuss' or 'now let us begin'. The first *sutra* of other five Darshans begins with the word *atha*. The beginning of a Darshan with the word *atha* indicates acknowledging and respecting the previous Darshans. Scholars suggest that being the first Darshan the Nyaaya Darshan does not begin with the word *atha*. Therefore, the Nyaaya Darshan is thought to be the first among the six Darshans.

One finds in the Vedic Literature several interesting correlations to support the chronology of the next five Darshans. For example Rishi Kapil, the author of Saankhya Darshan (third in the list), also wrote the *bhaasya* (interpretive commentary) on the Vaisheshik Darshan (2$^{nd}$ in the table) authored by Rishi Kanaad. Therefore, chronologically Vaisheshik precedes Saankhya Philosophy. Rishi Vedvyas, the author of Vedanta Sutra (6$^{th}$ in the table) and the epic book of Mahabharata, is also the author of the *bhaasya* on the Yoga Sutra of Rishi Patanjali (4$^{th}$ in Table 4.2). Therefore, the Yoga Sutra must precede Vedanta Sutra. Rishi Vedvyas also authored the *bhaasya* on the Poorva-Meemansa written by his own student Jaimini, his contemporary. This makes it easy to place the Vedanta Darshan in the last place in the chronology of the Darshans. The prefixes *poorv* and *uttar* to the word Meemansa of the last two Darshans respectively mean 'first' and 'later' indicating that chronologically Jaimini the student completed his Darshan, the Poorva-Meemansa, before his guru Rishi Vedvyas completed his, the Uttar-Meemansa.

The literal meaning of the term '*meemansa*' is 'thesis' or 'dissertation'. Historically, Rishi Vedvyas's Uttar-Meemansa is also addressed as the Vedanta Darshan and therefore the Poorva-Meemansa of Jaimini is popularly addressed as just the Meemansa Darshan without the *poorv* prefix to it. The Vedanta Sutra also has a not so common name Brahm-Meemansa. The given name 'Vedanta' to it also signifies the 'end of the sequence of Vedic philosophy'. Another equally popular name for the Vedanta Sutra is Brahm

Sutra because the subject matter of this Darshan is Brahmn, the God-entity. Swami Dayanand Sarasvati in his Satyarth Prakash (1881 CE publication) has referred to Brahm Sutra as Shaareerik Sutra as well. Thus, this last Darshan has five different names.

This bit of insight into the history of the last two Darshans also leads to the fact that both, Rishi Jaimini and Rishi Vedvyas and their literary works in the form of the two Darshans along with the book of Mahabharata, were contemporaneous. Based on the historical records discussed in Chapter 3, the historical period for the last two Darshans is expected to be just before 3140 BCE, the year of Yudhishthir's coronation and onset of Yudhishthir calendar.

# Mahabharata

Mahabharata (item 9 in Table 4.1) is the epic book containing the account of the Mahabharata War fought between the Kauravas and the Pandavas of the Lunar Dynasty. The book of Mahabharata gives a detailed description of the Mahabharata War. It was written by Rishi Vedvyas the author of the Brahm Sutra and his disciples. Compiling it and putting it in poetic form was a joint undertaking by Rishi Vedvyas and his disciples. The Mahabharata war ended about four decades before the milestone in the Vedic civilization at **February 18, 3102 BCE,** when the Vedic Creation Calendar's Kali-Yuga epoch began. As discussed in Chapter 3 this date has a direct relationship to astronomy, making it the onset of the Kali-yuga Samvat (calendar). This calendar is called the Srishti-Samvat as well where the word *srishti* means the 'creation of the universe' and *samvat* means the calendar. Because of its stability the Srishti-Samvat has been more important in the Vedic society than other practical calendars commencing after kings who have come and gone. The Aryans have kept track of this *srishti* calendar since the beginning of the Aryan civilization. Mahabharata is an event, a great war within two factions of a long running Lunar-Dynasty. This dynasty ruled from the city of Hastinapur. The present day Hastinapur town is in the state of Uttar Pradesh about 100 km north of Delhi, the present capital of India. Hastinapur is located close to the River Ganga (Ganges). The Mahabharata War was fought on the plains of Kurukshetra, west of Hastinapur, west of River Yamuna, which is about 160 km north-west of Delhi. Therefore this war is also known as the War of Kurukshetra. The city

of Indraprasth at the shore of the River Yamuna was newly established as the capital just before the Mahabharata War.

The war ended with the coronation of the Aryan king Yudhishthir, 38 years prior to the milestone in February of 3102 BCE. This history is well-known to the scholarly Aryans of India. Based on the astronomical data for the night-sky inscriptions available from Rishi Vedvyas's astronomical observations cited in the Mahabharata, it was established in Chapter 3 that the Mahabharata War was as real as World Wars I and II.

Rishi Vedvyas is variously referred to in the post-Mahabharat Sanskrit Literature. Vedvyas is a title and not his real name. The literal meaning of the term *vedvyas* is '*the diameter of the wheel of the Vedas*' with the connotation of the '*pivot of the Vedas*'. He acquired this name of honour because he was a great authority on the Vedas. His birth-name and the family name was Krishn Dvaipaayan where *dvaipaayan* means '*whose home was on an island*'; a descendant from an island. He was also addressed as Baadrayan, meaning '*whose home is in Badri*' probably because his immediate residence (ashram) was in the geographical area of Badri-vana. The Badri-vana is the Badri-forest situated along the foothills of the Himalayas. The Badrivana is known as such owing to the abundance of the *badri* fruit trees in this forest. The common name for *badri* fruit is *ber* (Indian jujube). Indigenous to India, the *badri* tree belongs to the Ziziphus mauritiana tree-classification. When fully pronounced, Vedvyas's name is Badaraayan Krishn Dvaipaayan Vedvyas. The references in the Book of Mahabharata and in other books in Sanskrit Literature indicate that he had a large ashram and *guru-kula* (residence school of higher learning) at the foothills of the Himalayas with many advanced level resident students. It is also mentioned in Mahabharata that he had an astronomical observatory on the shore of the River Sarasvati, which originated from the Shivalik Hills of the Himalayas. A place called Badrinaath in the Himalayan state of Uttaranchal is a likely place where his ashram once stood. It has been a highly revered pilgrim place for the Hindus over millennia.

The Himalayan pilgrim place Badrinaath has been of great spiritual significance that attracted Aadi Shankaracharya to travel from Kalady in Kerala state in Southern India to Badrinaath in the Uttaranchal in the Himalayas where he lived for about seven years before he went to establish the Dwarka Ashram in Gujarat. Badrinaath, also addressed as Badrikashram that Aadi Shankaracharya chose to establish his first Matha (monastery) in

2,600 years after Mahabharata and named it Jyotirmatha. The detailed historical account on Shankaracharya and the dates when he established the other four Mathas, during his travels is in Chapter 3.

Rishi Badaraayan Vedvyas belonged to a genealogy of learned people. Four generations of his family are known. His guru was his father Parashar and Parashar's guru was his own father Shakti. Rishi Vedvyas's genealogy ceased after his learned son Shukdev decided to devote his celibate life in learning and meditation. He renounced the world to lead a monastic life in search of self-realization. Thus there are no further descendants in Rishi Vedvyas' genealogy.

Rishi Vedvyas had four senior students: Pail, Vaishampayan, Jaimini (author of Meemansa Darshan) and Sumantu. After writing his account of Mahabharata, Vedvyas read it to his disciple Vaishampayan. After that in the Vedic philosophic tradition it must have gone through a critical examination and discussion phase leading to the finalization process where the highly valued outcome of the discussion was also included in the book of Mahabharata.

According to Vedic historical accounts, the Emperor Yudhishthir ruled for 36 years, 8 months and 25 days and renounced the throne to proceed to the Himalayas for meditation and self-realization with Draupadi and his other four brothers, Arjun, Bhim, Nakul and Sahadev. Arjun's son Abhimannyu died in the Mahabharata War when Abhimannyu's princess-wife Uttara was pregnant. When Uttara gave birth to Arjun's grand-son, Yogiraj Krishn named him Parikshith. When Yudhishthir renounced the throne of Indraprasth, Parikshith's coronation took place when he was 35 years old. Parikshith ruled for 60 years, 0 months and 0 days when Janmejay followed on the throne in succession at Indraprasth. Rishi Vedvyas's student Vaishampayan recited and presented the book of Mahabharata to the King Janmejay on the occasion of the parliamentary session named '*sarp-satra*'. On the basis of some ancient references Swami Dayanand Sarasvati wrote in his book Satyarth Prakash that when the book of Mahabharata was first completed, it had a total of 10,000 *shlokas* (poetic couplets) of which 4,400 were composed by Rishi Vedvyas himself and the remaining 5,600 were composed by his four students.

The book of Mahabharata is in 18 divisions called the *Parvs* with each *Parv* identified with its subject heading. There are a number of chapters within each *Parv* with each chapter having a number of *shloka*-couplets. The

book of Bhagvadgita, a well-known book in the West, is the sermon given by Yogiraj Krishn to Prince Arjuna at the battle field of Kurukshetra and it is a part of the book of Mahabharata. Bhagvadgita has 18 chapters in it which are the 23rd to the 40th chapters of the 6th *Parv* of Mahabharata, titled as the *Bhishm-Parv*. Yogiraj Krishn's birth name is the same as Vedvyas's birth name. However, both were different persons but contemporaneous great personalities of the Vedic civilization.

Krishn in Bhagvadgita, a part of the book of Mahabharata, has cited references of the Darshans. For example the Saankhya Darshan has been referred to 5 to 6 times in the *shlokas* (2/39, 3/3, 5/4-5, 13/25, 18/13). In addition, the *shloka* (6/35) in Bhagvadgita has in it the Yog Darshan's *sutra* (1/12) and so on. Therefore, the last two Darshan's must have been written just before the Mahabharata War began. Mahabharata has several references of Manusmriti, placing Manusmriti anterior to the Milestone at the onset of the Kali-Yuga calendar. Since all Darshanic principles in the six Vedic Darshans have their origin in the Vedas, all Vedas are before the Milestone.

The Vedic civilization started to decline several centuries after the Mahabharata War. This was also a time of turmoil and destabilization of the settlements along the shores of the mighty River Sarasvati. Due to cataclysmic events in the geologically sensitive region at the foot-hills of the Himalayas, the flow of the river was disrupted leading to the ultimate extinction of the River Sarasvati. As discussed in Chapter 3, these facts are now confirmed by new technology, satellite mapping and geological research. The excavations along the course of the rediscovered extinct River Sarasvati have revealed thousands of these settlements where Vedic civilization had once flourished. During the dark period after the Mahabharata War, the well-established *guru-kulas*, like Rishi Vedvyas', declined and perhaps disappeared with the high level of language and script also vanishing from the common masses. About a thousand years BCE the caste superiority and caste rigidity took root in the Vedic society, when some people in the priestly brahman community controlled education, keeping the knowledge of Sanskrit within the brahman community. For the financial gain and power some members of the priestly community propagated blind beliefs and as a consequence the ritualistic Hinduism gained the foot-hold. They gave their own erroneous interpretation to the Vedic texts and forbade women and the so-called lower castes from reading and studying the Vedas. To fulfil their own ulterior motives, some of them created self-serving

*shlokas* and inserted them in the book of Mahabharata and Manusmriti. The book of Mahabharata, according to ancient references, as discussed by Swami Dayanand Sarasvati in his Satyarth Prakash, originally had 10,000 *shlokas*, which now has about 100,000 *shlokas*.

As a result of this literary pollution, one finds many inserted *shlokas* contradicting the original *shlokas* written by Rishi Vedvyas and his students. Confusion is imminent when inserted *shlokas* present un-Vedic opposing philosophical views and ritualistic practices. Most scholars accept the fact that the present Mahabharata is a corrupted version of the original and is artificially enlarged. This has led some Indologists to believe that the entire Mahabharata was written about 300 to 400 BCE and that it may altogether be a fictitious story. Fortunately the research by Vedic scholars of the Vedas, Vedic Literature and the recorded historical documents, has established the reality of the Mahabharata War and the book of Mahabharata.

## Puranas

Puranas (item 10 in Table 4.1) are the religious books of Hindus with history and mythology in them. They are a set of 18 books which are a part of the Sanskrit Literature because they are written in Sanskrit and also because they have been written about half a millennia BCE through a few centuries CE, which by some standards is considered to be ancient. They are the source of ritualistic practices in Hinduism where there is prevalence of mythology, idol worship, worship of multitude of gods and goddesses in differing forms, belief in reincarnations of God in the form of a human being, ritualistic worship of gurus and many other such beliefs. The Vedic exhortation being diametrically opposite to this, the Puranas could be included in the Sanskrit Literature but could not be included in the Vedic Literature. This is why the title Puranas in Table 4.1 is in brackets.

Based on his deep knowledge of Sanskrit Literature and Hindu history, Swami Dayanand Sarasvati has included considerable historical information in the 11$^{th}$ chapter of Satyarth Prakash (1881 CE). From a history book written in 1725 CE he furnished the tables of successive genealogy records

of 124 Aryan kings who ruled from Hastinapur (Delhi) over a period of 5,157 years starting near 3,140 BCE. The details on this are in Chapter 3.

He states that King Bhoj ruled from Avantika (Ujjain) about 500 years after the great king Vikramaditya. Regarding the Puranas, he writes that the Vaishnav-Hindu sect began 150 years after King Bhoj of Ujjain (about 600 CE). The founder of the Vaishnavait sect was Shathkopa. Munivahan and Yavanacharya (of Greek origin) later propagated this sect and popularized it by the well-known Ramanuja. The Vishnu-Purana was also written during that time for the propagation of the Vaishnavait-Hindu sect.

Likewise, the Shiv-Purana was written for the Shaivait Hindus. Many other Puranas also sprang up during this period of the Indian history. To give legitimacy, to gain authenticity and respect and to promote their sects the authors of these Puranas wrote them under the names of the great *rishis* of the past. Rishi Vedvyas, the author of the Vedanta Sutra and the book of Mahabharata, became their target. As a result, those following the Puranas believe that Rishi Vedvyas was also the author of all the 18 Puranas. This is also the time when some pundits who followed the Puranik Hinduism and other pundits who followed other non-Hindu sects, composed and inserted texts in the ancient books such as Ramayan, Mahabharata, the Smritis and several other post Vedic books.

Swami Dayanand Sarasvati wrote that during the rule of King Bhoj a group of pundits created Markandeya-Purana and Shiv-Purana in the name of Rishi Vedvyas, who in fact had lived over three and a half thousand years before King Bhoj. For bringing the great Rishi Vedvyas' name into disrepute and creating pollution in the revered Vedic Literature, King Bhoj punished the writer pundits and had their hands cutoff. Thereafter he issued a directive throughout his kingdom that anyone creating any poetry should do so in their own name and not in the name of the revered ancient *rishis* and the sages. Swami Dayanand Sarasvati also cites that the learned King Bhoj wrote a history book entitled 'Sanjeevani', which is one more example of the Indian tradition of recording history. Swami Dayanand Sarasvati cites a statement by King Bhoj from the book of 'Sanjeevani':-

> "*… at the time of King Vikramaditya* (57 BCE)*, Mahabharata book contained 20,000 shlokas, at the time of my father there were 25,000 shlokas and in my half lifetime alone the book of Mahabharata contains 30,000 shlokas. If it continues to grow like this it will turn into a camel-load and if people created books like Puranas in the name of the rishis*

*and the sages, the people of Aryavart will be entangled in the net of doubts and will become devoid of Vedic dharma and become bhrasht* (defiled)*"*.

The insertions of *shlokas* in the book of Mahabharata continued clandestinely in spite of King Bhoj's strong directive. As the King had predicted, the doubt and confusion persists in the interpretations of the scriptures. The underground process of writing of the Puranas continued after King Bhoj and their number increased to 18.

All Hindus accept that the Vedas are their most ancient books and there are no insertions in them by post-Veda writers and Puranik pundits. There are several reasons why the Vedas have not been sullied by insertions. The Aryans revere Vedas as the revelation by God in the minds of the *rishis* and therefore do not need further improvement. In addition, the unique Vedic poetry is difficult to emulate even by the scholarly. The Veda mantras being in unique seven different metered *chhandas* also made it difficult for a polluter to insert his dross. An important factor for preserving the integrity of the Vedas is the Vedic tradition of the scholars learning the Vedas by heart, mantra by mantra, in the same sequence and reciting them without even a slight variation of a syllable. For fear of a quick detection of the insertion, the Vedas remained untouched by the literary polluters.

In his effort to revive the Vedas and the Vedic practices and to point out the negative influence of the prevailing books of Puranas on the Hindu society, Swami Dayanand Sarasvati, born and brought up in a priestly brahman family himself, said that the true meaning of the word Purana was lost and misused by the brahman caste. To emphasize this in the 11th chapter of his book Satyarth Prakash he cited references from the Vedas and the Brahmana books. A reference from there is as follows –

ब्राह्मणानीतिहासान् पुराणानि कल्पान् गाथा नाराशंसीरिति ॥

**Transliteration:**

(*Brahmanaaneetihaasaan puraanaani kalpaan gaatha naaraashanseeriti*.)

**Translation:**

"*The Brahmana-books* (Etreya, Shatpath, Saam and Gopath) *are addressed with five names: itihaas, purana, kalp, gaathaa and naaraashansi*."

To explained with mastery the five Vedic terms in the above-cited reference by giving examples from the Brahmana books Swami Dayanand Sarasvati, the scholar par-excellence, dives deep into the ocean of Vedic Literature and brings out the pearls of literary definitions otherwise would have remained hidden. He writes (in Hindi):

> " *…the philosophical dialogue between the King Janak and Rishi Yaagyavalkya is* ***itihaas*** *(history); the description and elaboration on the creation of the universe and the other phenomenon of Nature is* ***purana*** *(account of, a reckoning); the process of defining, elaborating and manifestation of the ingenuity of Vedic terminology is* ***kalp****; description of a phenomenon of importance with examples and similes is* ***gaathaa*** *(i.e. rendition with proof and example) and the word* ***naaraashansi*** *stands for describing the inspirational and approved karma of people* ".

Some of the 18 Puranas do contain valuable history of the society in the form of the genealogy of kings and information on events in the society. Whereas the Puranik history of the society relates to the real persons of the Vedic society, the Puranas have also included commentary on the history of the creation of the universe. This history at times has some correlation to the Veda mantras and the statements in the Brahmana books and at other times, it contains absurd imagination on the subject of the creation of the universe. They are far from the depth of thought in the Brahmana books, which cover various aspects of the society as well as the aspects of the creation of the universe.

The 18 Puranas themselves are huge volumes of Sanskrit poetry and there are an additional set of 30 other Puranas termed as Up-Puranas (sub-Puranas) that also come in the category of Puranas, with a total *shloka* count of over 4 million (4,329,000 *shlokas*). Therefore, even for a diligent and eager student of Sanskrit Literature, who has chosen a Purana to be the starting point, the Puranik Literature alone will be quite overwhelming before entering the realm of the Vedas and the Sutras. As said before, the Sanskrit Literature is vast; it is an ocean of ancient literary work.

Western Indologists and the Western professors of Sanskrit of 18$^{th}$ and 19$^{th}$ century, including Professor Max Muller who translated RigVeda in English followed the writings and the interpretation of the Puranik scholars. Contemporaneous to this new Vedic European literature in English and in

other European languages, were Swami Dayanand Sarasvati's interpretive translations of the RigVeda and the YajurVeda in the Hindi language. His translation of course followed the methodology prescribed by the ancient *rishis*. At places in his translation, he has commented on the specific deficiencies in the translations of Indian authors like Sayana and Mahidhara as well as on the mantra mistranslations by the European Sanskritists, Max Muller included, where he made it abundantly clear that those authors lacked competency in the grasp of Sanskrit grammar and the language itself.

The references related to cosmology and the developments of other thoughts in this book are primarily drawn from the ancient texts listed in the Table 4.1. It was established in Chapter 3 that the main Vedic references on cosmology, used by this author, precede 3200 BCE and the translations of the mantras are based on *yaugik* meanings and ancient methodology prescribed in Nirukt and emphasized by Swami Dayanand Sarasvati.

# Oral and Writing Traditions of the Aryans

The process of learning for all humans begins orally. It is debatable as to how soon after the conception of a child the process of oral learning begins. New references on this topic could be found in modern science publications, however, an ancient reference is found in the book of Mahabharata (item 9 in Table 4.1), written over 5,000 years ago. The process of oral teaching and learning according to this reference becomes operational for the child soon after conception. Prince Arjun and his queen Subhadra (sister of Krishn) talked purposefully about specific strategies to their brilliant son Abhimanyu when he was in his mother's womb. Mahabharata states that when Abhimanyu was only a teenager he implemented the complex *chakravyuh* war-strategy successfully without pre-training in it. It is believed that the process of learning through oral vibrations in the mother's voice begins when the child is still in mother's womb.

The knowledge senses according to the Vedic philosophy are seeded in a living being at the moment of conception and they develop from there on and become active right after the birth. It is also known that a large number of words and sounds are absorbed and stored in the child's brain before the child learns to speak, read and write. The oral process of teaching and learning is thus in place from the very beginning of the child's life which

ultimately develops into a language for communication. The oral process could continue indefinitely into adulthood if the written script was not taught or nonexistent. The minimum requirement for oral learning is the preexistence of nomenclature of objects, phenomena and processes in the person's environment and some grammar to communicate the words in a given meaningful sequence. The larger the vocabulary in a language of communication, the higher is the possibility of social development and civility in a person and in the society as a whole.

Some civilizations have carried out their business in an oral tradition while others have invented scripts to carry forward the process of learning and communication. The process of passing knowledge from one generation to the next is better served when the writing tradition is in place along with the oral tradition. The society that emphasizes both traditions is better off than a society managing with the oral tradition alone or the society that has a high emphasis on the writing tradition but little value for oral learning.

There are misconceptions about the tradition of teaching and learning in Vedic Civilization of ancient India. Based on guesswork, hearsay and without citing a reference Max Muller who never set foot on the Indian soil fielded several myths about the Vedic Civilization. His myths about the Aryan Hypothesis (AH) and Aryan Invasion Theory (AIT) were debunked in Chapter 3. He emphatically fielded another myth that the Aryans had only the oral tradition of teaching and learning and the script did not exist in India until 300 BCE. He also emphasized that because there was no script the Indians did not record their history and were not good at it. Max Muller took it upon himself to write India's ancient history and compressed last 5,000 years into 2,000 years bringing most historical events from BCE to CE and declaring the rest as fictional.

Some Indians have high reverence for Professor Max Muller but other proud Indians are deeply saddened by the irreversible damage he has done to the Indian culture, literature and the Vedic Civilization. His translations of Sanskrit Literature, the RigVeda in particular, have remained like an irreversible chemical reaction where the participating molecules lose their identity. In his lecture series at Cambridge, entitled 'India - What Can It Teach Us?' (publ. 1882 CE) he writes in its VII chapter:

> "*Here then we have the first fact, viz, that writing, even for monumental purposes, was unknown in India before the third century BC*."

He further writes:

> '*…the art of writing may have reached India before the time of Alexander's conquest (325 BC), its employment for literary purposes cannot date from a much earlier time***."**

Then after a few paragraphs, he wonders:

> "*Here then we are brought face to face with a most startling fact. Writing was unknown in India before the fourth century before Christ, and yet we are asked to believe that the Vedic literature (in its present form) … goes back to at least a thousand years before our era.*
>
> *Now the Rigveda alone which contains a collection of ten books of hymns addressed to various deities consists of 1017 poems, 10,580 verses, and about 153,826 words. How were these poems composed – for they are composed in very perfect meter – and how, after having been composed, were they handed down from 1500 before Christ to 1500 after Christ, the time to which most of our best Sanskrit MSS belong*?"

There are a number of errors in his count. The total number of poems (*suktas* or hymns) in RigVeda is 1028, not 1017, and the total number of verses (mantras) is 10,521 and not 10,580. Max Muller's above-mentioned guesstimates within two pages of the same chapter of his book exhibit other errors as well. First, he stated without literary or historical analysis that writing was unknown in India before the third century BC. Next, he said that it was unknown until the fourth century BC. Finally, he wondered how, without the written manuscript, over a 1000 poems composed in perfect meter, could have been handed down from 1500 BC to 1500 AD. Max Muller's guesstimates reveal his inadequate historical analysis and inadequate study of the Sanskrit Literature.

India was under the British rule at the time of the influx of the Western Indologists into India; Max Muller remained in England. The British had devised a cunning strategy of 'divide and rule' India. For this, they implemented an education system that discouraged Indians from learning about their glorious past. Additionally, this system included newly created texts with distortions in the ancient Indian history. The British history reveals that Lord Macaulay in 1834 CE commissioned Max Muller to

translate (mistranslate) the RigVeda into English for a payment of 4 shillings per page.

How then does a foreigner justify rewriting the history of another country? He has to come up with a solid reason for doing so. A solid reason could be that the natives were uneducated and needed his input. This however was not the case with the Aryan natives of India. The Aryans of the past had created vast Sanskrit Literature that the present Aryans had inherited in the manuscript form, in a highly developed script in a scientific language built on an admirable grammatical structure and philosophical foundation. Then if the foreigner still insisted on rewriting the history of the country, he had to create a myth that – '*the natives were educated but not in a habit of writing history*'. This myth worked for Max Muller who supplemented it by saying that the natives of India had an oral tradition of teaching and learning but did not have a script; therefore, they were not good at recording their history. To borrow an expression from his own quotation cited above, Max Muller came *face to face with a most startling fact*. This fact is: if Indians were able to hand down accurately the 'complex and vast poetry' of the Vedas in the written form to the later generations, at least from 1500 BC to 1500 AD as he said, then why were they not capable of writing-recording and handing down their ancient history? Obviously, he ignored the simple logic.

After creating the myth that "*writing was unknown in India before the third century BC*", he needed an explanation as to how the massive Sanskrit Literature could have flourished without a script. So he created another myth that "…*the art of writing may have reached India*…" presumably from somewhere outside of India, around the time of Alexander's invasion (325 BC). If his doubts about the historicity of the Sanskrit Literature were genuine, he could have learnt from the Sanskrit Literature itself that writing was prevalent in the Vedic society along with the oral tradition.

Let us bring in some ancient references from the Vedic Literature to show that the writing process existed in India from ancient times. These references are the book of Nirukt by Rishi Yask and the book of Ashtaddhyayi-Grammar by Rishi Paanini. As Acharya Udayaveer Shastri has analyzed this point in "Vedant Darshan Ka Itihas" and some other contemporary Hindi writers have also pointed out that while interpreting Vedic terms in the Nirukt Sutra, Yask Rishi frequently uses the term – *uprishtaad vyakhyasaamah,* meaning '*we will establish this further in what*

*follows*'. Such expressions suggest that there will be further discussion to establish the point being made in the written text of the book of Nirukt. With reference to the definition of terms and expressions, the book of Nirukt has also referred to about 14 other *acharyas* (scholars) either contemporary to Rishi Yask or before him. His references to these 14 Acharyas indicate the existence of literary works in textbook form prior to him. Rishi Yask's period by Sanskrit scholars is estimated to be anterior of 1900 BCE.

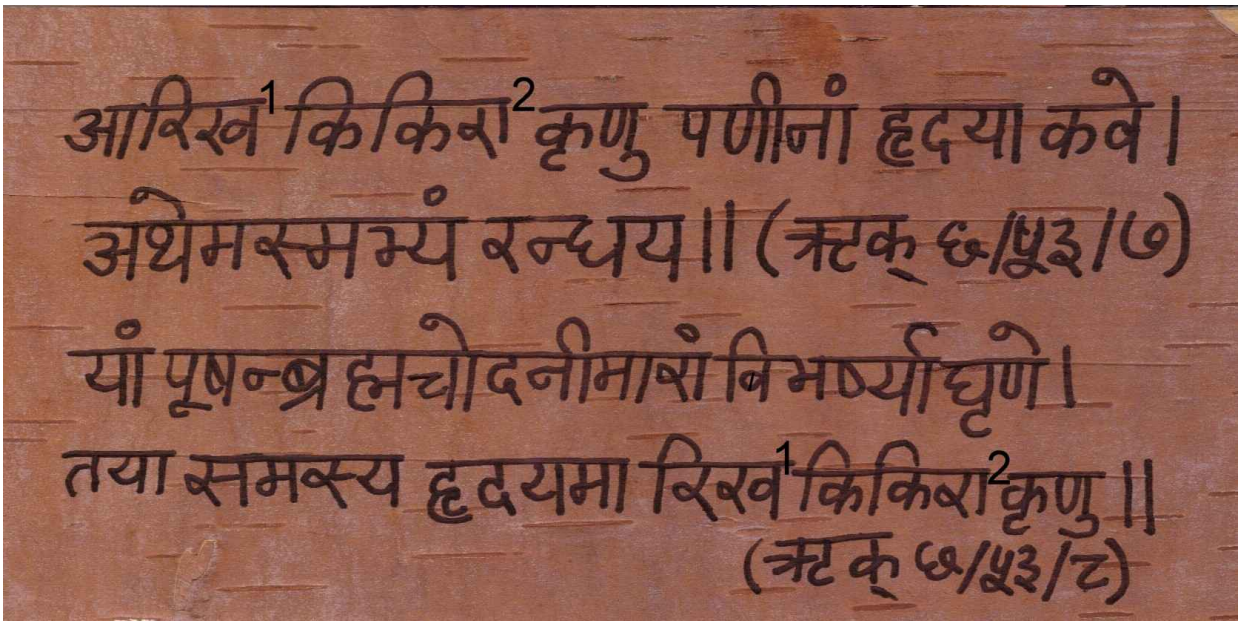
Rishi Paanini has used the term *lipi* in his book on Sanskrit grammar. The term *lipi* means 'script'. Rishi Paanini would use the word *lipi* only when the script existed in his time. Even if one wishes to discount Rishi Paanini's period, estimated to be before 2707 BCE (ref. Vidyanand Sarasvati, 1989), one fact remains that Rishi Paanini lived before Rishi Yask's period and certainly before the advent of Buddhism. It is also well known that Buddhism began before the time of Aadi Shankaracharya and was at its peak in India during his time. Based on deep literary research in ancient documents guarded at the Shankaracharya monasteries in India, Acharya Udayaveer Shastri (mentioned above) has established the dates of birth, death and other events in Shankaracharya's short life. This places Shankaracharya's birth on *Baishakha, shukla panchami*, 2631 in Yudhishthir Calendar, which is the 5$^{th}$ day of the 2$^{nd}$ month in the Vedic calendar. This translates to the month of April in 509 BCE. He lived exactly for 32 years 6 months and 10 days. This proves that Indians were very good at keeping historical records. Thus, the Indians have had *lipi* (script) at least in the 6$^{th}$ century BCE.

In his thorough analysis of the Vedic Literature and history, Pundit Yudhishthir Meemansak, a prominent Sanskrit scholar and a prolific writer of Vedic Literature, has provided in the first part of his highly acclaimed book 'Sanskrit Vyakaran-shastra Ka Itihaas' (History of Sanskrit Grammar), a proof of the fact that Rishi Paanini wrote his Ashtaddhyayi-grammar about 400 years after Mahabharata War. As mentioned before, and proven in Chapter 3 the Mahabharata War ended in 3140 BCE with the coronation of the King Yudhishthir. This takes us close to 2900 BCE. Therefore, *lipi* (script) in India existed well before the speculative dates of Max Muller and all those Sanskritists who accept his guesstimates of the time-lines of the Vedic Literature.

This author will now take the reader even further into the antiquity of the Indian civilization, well before Rishi Paanini's time, deep into the past of

the Indian civilization anterior to the Mahabharata War, to show that the written script has been a part of the Vedic Civilization from its very beginning. The book of RigVeda itself has instructions for having the practice of writing and record-keeping in the society, which can be possible only when a script is in place. In the following are several references that clearly indicate the existence of script in India for writing and record keeping. Some historical records are also furnished here to show that the ancient Indian society recognized the importance of preserving and propagating its developed knowledge base for the benefit of the future generations. This is very similar to the way in which knowledge is preserved and disseminated in the modern societies.

Max Muller and the other Sanskritists and Indologists missed reading the following set of successive RigVeda mantras, which issue a directive to the judiciary of the society for record- keeping.




**Transliterations**:

"*Aa rikh[1] kikira[2] krinu paneenaam hridayaa kave. Athemasmabhyam randhaya.*)" (RigVeda, 6/53/7).

"*Yaam pŏoshanbrahmchodnimaaraam bibharsha ghrine.*
*Taya samasy hridayama rikh kikira krinu*."

(RigVeda, 6/53/8)

**Mantra translations**:

*"O learned people, prepare detailed written records covering all facts on unsocial and criminal persons and punish them severely to change their heart and thus provide comfort to the rest"* (RigVeda, 6/53/7).

"*O the learned one, propagator and upholder of justice, use your justice to separate the truth from untruth like a saw separates wood pieces. Prepare written record covering all facts on those who provide proof and who inspire for knowledge and wealth*" (RigVeda, 6/53/8).

The directive is for both aspects of the judiciary - the execution of the clear-cut judgment and the writing of the detailed judgment. The Veda did not consider it sufficient for a judge to pass a judgment orally and move on to the next case. It instructed the judiciary to keep detailed records of all facts from both sides - the plaintiff's side and the defendant's side. The writing of a judgment by the judiciary is possible only with the preexistence of a script. In addition to the Veda taking for granted that the people already have invented a functioning script, an added beauty in the mantra is the simile of the 'wood and saw'. The Veda instructs a judge to pass a clear judgment just like a saw cuts wood into two distinct pieces, truth on one side and false-hood on the other. Thus, the Aryans, the followers of the Vedas, had read the RigVeda (script) had worked to iron out wrinkles in the laws governing their Vedic society and had developed a constitution to follow. The book of Manusmriti is such a constitution.

There are two important words that are repeated in two different contexts in the above two mantras; in one context the emphasis is on the criminal, the unsocial accused ($7^{th}$ mantra) and in the other context the emphasis is on the plaintiff ($8^{th}$ mantra). These words are आ रिख[1] and किकिरा[2] (*aa rikh*[1], *kikira*[2]). The words आ रिख[1] (*aa rikh*[1]) mean '*write in detail covering all facts*' and किकिरा[2] (*kikira*[2]) means '*written papers or written record or a report*' (all these meanings apply). These two mantras therefore summarize the whole process of a judgment by a judge where the

record-keeping of a case is a must. This process of maintaining a record of a case in a judicial process, true in the present day society as well, is not possible without script.

The Vedas for the Aryans are the word of God. The expression – 'word of God', for Aryans has a different meaning than in other religions. God in the Vedic concept does not create sound for pronouncing words. This word is not like a deep voice calling from the sky. In the Vedic thought, all knowledge emanates from the all-pervading formless Conscious-being, the Creator, and each word is the result of the vibrations in that knowledge plane. These vibrations inspired the elevated minds of the *rishis* and sages in their meditation who gave these vibrations the sound (*shabd*) by pronouncing and subsequently giving them shape by writing in script. The Vedas are the collection of that divine knowledge put forth in the form of unique and perfect mantra poetry.

Therefore, it is natural for an Aryan to follow the instruction in a Veda mantra. As defined in the Veda itself the term *arya* means *eeshvar-putra*, which means the 'progeny of God' and therefore the term *arya* stands for '*a noble person*'. A progeny first begins learning to speak from its mother and is always eager to learn more. The Creator in the Vedas is therefore also addressed as a mother. The Aryans read and believe that all instructions in the Veda are for the benefit of all humanity and the rest of the creation and therefore an *arya* is to follow the written instruction prescribed in the Veda since the ancient times. To say that the Indians did not develop script until three centuries BC defies logic.

This author feels that inventing a script in which to express a language is not as difficult as developing the language itself. What is even more difficult is to formalize the grammar of that language. Then if the grammar of Sanskrit is extremely complex and scientific, it indicates a high level of development in the society. The script (*lipi*) in this author's thinking is of tertiary importance after the creation of a word (*shabd*) in the mind and pronouncing it through the voice (*sarasvati*). If the language is in place, the script would naturally follow.

The name for the Sanskrit script is Devnagari. The curvaceous letters stand in a unique style. It has been an independent script and has existed from the time of the Vedas to the present time. All the mantras in this text are in the same Devnagari script. To demonstrate the ancient practice of writing mantras on an ancient writing medium, this author hand-wrote the

above two mantras on *bhoj-patra*. A discussion on *bhoj-patra* (bark of the *bhoj* tree) and other ancient writing media is in the following.

RigVeda states unequivocally that a hand is to be used for writing. Not just that, but the mantra also instructs the reader to prepare a system by which the writing process can be achieved much faster, a thousand times faster than hand.

**Transliteration:**

"O͡op1 tva saataye naro2 vipraaso yanti3 dheetibhih4.
ŏopaakshara5 sahashrinee6"

**Mantra translation**:

"*Just as the learned persons with diligent effort produce akshara[5] (letters of script) using fingers of the hand[4], O (man[2]) desirous of knowledge, prepare a well thought out system (instrument[3]) in collaboration with intellectuals to produce them thousands[6] of times faster than a hand*" (RigVeda, 7/15/9).

In this mantra, the word *naro*[2] *(naraha)* stands for human beings and *dheetibhihi*[4] according to the Nirukt (5/2/5/41) means - '*by the use of human hand'*. In this Nirukt reference, there is another RigVeda mantra with its Samhita reference number (5/1/23/1) being taken up by Rishi Yask for interpretation wherein the instruction is to create fire by a mechanical process. The common factor in the two mantras is the use of the human fingers. The instruction in the mantra under the Nirukt interpretation is to use the fingers to produce fire as - '*use fingers to rotate arani fast to create fire by attrition (friction)*'. Rishi Yask in his Nirukt (>1900 BCE) has given the definition of the Vedic term *arani*. An *arani* is an object '*that creates aran*

(motion) *in the hidden agni* (fire) *by association of hand'*. Even in the present day Indian society the term *arani* is in common usage for a 'hand-held spindle'. As analyzed in Nirukt by Rishi Yask, the Vedic term *dheetibhih*[4] in the above RigVeda mantra (7/15/9) is for the use of the hand for writing. The term *didhiti* in the other RigVeda Samhita reference (5/1/23/1) implies the same meaning for creating fire with an *arani*. It is the use of the 'human fingers'-- use the fingers to hold a pen to write the script and use the fingers to hold an *arani* to create fire by attrition.

The above mantra tells us - 'use your hand' to generate writing of *akshara*[5] where the term *akshara*[5] means the letters of a script. The word *ŏopaakshara*[5] is in fact a euphonic combination of *ŏop* and *akshara*[5] which together mean the 'secondary letters' or the 'resulting letters'; which means that the letters are primarily created in the mind and then secondarily reproduced by hand on a medium. We all accept the fact that humans after inventing the script began writing the *akshara* with hand and therefore a human hand is the oldest instrument for word processing in the human civilization. A human hand in the Sanskrit terminology has five fingers; the thumb is also counted as a finger. Thus, the term *dheetibhihi* represents all five fingers in the human hand and is the naturally contrived biological instrument for writing.

The most important feature of the mantra is the instruction in it for going beyond the biological instrument, the hand. The mantra explicitly suggests speeding up the process of writing to *sahasrinee*[6], which appearing in plural means '*thousands*'. In common figure of speech, this expression is similar to '*a thousand times*' and therefore the mantra's emphasis is to achieve a much higher speed in the process of writing than the speed attainable by a hand. This also tells us that the mantra is not instructing one to write faster and faster by hand; rather it is explicitly telling us to devise the process to increase the speed of writing thousands of times faster than the speed of hand-writing. Additionally, the mantra instructs to achieve this in collaboration with other scholarly intellectuals.

First a theoretical aspect of the instruction in the mantra: The terms *ŏop*[1] and *yanti*[3] in the first line are separated unlike in the first compound term *ŏop-akshara*[5] of the second line in the mantra. Linguistically they are also in a euphonic combination. Therefore, when taken together the compound word *ŏop*[1]*-yanti*[3] would lead to the meaning - '*a well thought out resultant plan (or system)'*. When other root meanings of the word *yanti* are

considered, one finds that, it also stands for '*in an organized method*' or '*in a controlled method*'. These closely related meanings obviously are for developing a plan or a process for speeding up the writing process.

Now let us look into the practical aspect of the meaning of *ŏop-yanti*. A derivative of the term *yanti* is the term *yantra*, which conveys the *yaugik* meaning of '*that which alleviates one's suffering*'. This is why, the term *yantra* in common usage is for 'instrument' that helps to reduce the pain and suffering of the physical body. The two words together forming a single term *ŏop-yantra* is also an alternative to the most commonly used term *ŏop-karan* in most regional languages of India that have their root in Sanskrit. The term *ŏopkaran* is commonly used for an instrument or for an instrumental aid. A telescope for example is a *ŏopkaran* (secondary instrument) to enhance the capability of the eye where the eye is a *karan* (the primary doer of action). A car is a *yantra* or *ŏopyantra* to alleviate the suffering in walking long distances. A machine in general is a *ŏopkaran* or a *ŏopyantra*. An instrument by definition enhances the ability of a sense and the Sanskrit term for sense is *karan*. The mantra is encouraging the practical aspect of speedwriting. Going beyond a hand is possible with a machine (*yantra*). Since not all scholarly necessarily have a technical bent of mind for developing and implementing technical *ŏopkarans* (instruments), the mantra additionally instructs the reader to achieve the goal of speed-scripting with the help of other talented accomplished people. To develop the process of writing further, the humans have used various methods, media and aids. Later the humans have gone way beyond and invented mechanized instruments for writing such as typewriters, printing-machines and computerized printers that have enabled the script writing a thousand times faster than a hand.

Now, if we were to revisit the mantra translation from a modern perspective, the mantra translation would not be too far from - *develop a fast mechanical system to carry out the process of writing a thousand times faster than the hand*. The Veda, which the Aryans consider the source of all knowledge, advises humans to invent the process of writing by hand and 'thousands of times' faster by mechanical means. One needs script for a machine to print!

An *akshara* (letter) can be taught using only the auditory method of listening and pronouncing. The *ŏopkarans* utilized for that are the voice and the 'sense of hearing'. Nevertheless, the real meaning and purpose of the *akshara* are enhanced when its distinct geometric shape is visually

recognizable. This adds an additional *karan* to the process, the sense of seeing. As mentioned before the root meaning of the word *akshara* itself is '*a non-decaying entity*' or '*a non-diminishing entity*'. This in mathematical terminology is the 'invariant'. In most languages a letter is just a symbol to represent a sound where its components, 'le - tt - er' themselves have no deeper meaning in them. In Sanskrit on the other hand, the term *akshara* conveys the quantized power of an entity that for all purposes is abstract, with no subsistence in it. One could dismantle a word into many letters (*aksharas*) by separating all its *aksharas,* but an *akshara* itself continues to exist. This also means that just as matter at its fundamental state is quantized without a quantum being further divisible, the language is made up of words that are divisible into *akshara,* an entity not divisible further. In Sanskrit however the half-*akshara* are also used when an *akshara* is pronounced for shortened sound. This line of thinking on the part of the *rishis*, where giving meaningful nomenclature to an entity that reflected the properties of the entity, is science (*vigjyaan*). The structure of the Sanskrit language and the structure of matter are similar. Two hydrogen atoms and one oxygen atom form a water molecule with its chemical formula being $H_2O$. The water molecule is like a word dismantling into its 'non-decaying *aksharas*: H, H and O. Therefore, while naming a letter as *akshara* the *rishi* left a stamp on it that an *akshara* is a fundamental building block of words in a way similar to H, H and O are in a water molecule. What atoms are to a molecule the *aksharas* are to the word. This is the case of all *aksharas* in the Sanskrit script, which with given rules together form the words of the script. Sanskrit script, which is Devnagri script, has the built-in integrity of being phonetically consistent, unlike the English language in which for example the same *akshara* 'u' carries different sounds as in the words 'but' and 'put'.

Different languages of the world have differing numbers of *aksharas* (letters) in their scripts. For example, there are 63 in Sanskrit script including the vowels and the consonants, 24 in Greek, 23 in Latin, 26 in English and so on. Thus, as soon as an *akshara* appears, the writing process begins. It becomes clear from the above mantra references that as far as the Vedic reading and writing is concerned there has not been a separation of verbal recitation and the writing process. RigVeda the oldest book of the Aryans clearly advises to develop both, the Vedic tradition of oral learning as well as of writing by hand and writing with the aid of *ŏopkaran* (instrument).

It may be of interest for the reader to know that unlike the previous handwritten mantras, the last mantra above (RigVeda, 7/15/9) was typed in Devnagari (Sanskrit) font by this author using the keyboard and printed using an electronic printer. To accomplish this, a sheet of *bhoj-patra* was fed through the printer. This certainly expedited the process perhaps a thousand times, as the above mantra instructed one to do! A *bhoj-patra* is the naturally occurring writing material for the Vedic Aryans to write on and to preserve the written Vedic text. A few more words on *bhoj-patra* are in the following.

This section is concluded by presenting only the first line of a mantra from AtharvaVeda that should remove all doubts about the myth that the Aryans did not have the script to write in and had only the oral tradition of learning. The relevant part of this mantra states:

यस्मात् कोशादुदभराम वेदं तस्मिन्नंतरव दध्म ।.....

(AtharvVeda, 19/72/1)

**Transliteration**: "*Yasmaat koshaadudbharaam vedam tasminnantarav dadhma*"

**Mantra translation**:

" *Just as the book of Veda is taken out of the chest and returned to it after reading, the Vedic knowledge emanates from God and returns to Him* (on dissolution of the creation) …" (AtharvaVeda, 19/72/1).

In a typical Vedic style, the mantra explains a phenomenon from the spiritual realm by using a simile from the practical daily activities of life in the physical realm. The Veda in the physical realm is a book of knowledge, a physical object that is brought out of a chest for reading and returned to it for safekeeping. In the spiritual realm, the Veda is the knowledge itself, a non-physical entity that emanated from the Omniscient and returns to Him at the time of the dissolution of the creation.

This mantra of AtharvaVeda completely negates the hypothesis that the Aryans had only the oral system of learning because one can take a book out from a chest and return to it, only when it was in the written form. This activity by an Aryan is possible when a script existed and the process of writing was in place, all the time right from antiquity. This mantra puts a 'double-strikethrough' in the conjecture of Max Muller et al. and all those

who still insist that the Aryans only had the oral tradition of teaching and learning.

Whereas it was advisable for a student to learn to recite all Vedas in their entirety (in up to 13 different ways), he/she was also advised to complete a prescribed curriculum to finish his/her education. Depending on how much study one aimed to take up, the prescribed study period in the Vedic education system ranged up to the age of 25 to 35 years. Except for some geniuses, it was impossible for the average students to cram the vast Vedic Literature, both in prose and poetry, preserving the accuracy of the text and the sanctity of the knowledge. To learn by heart all the mantras from the four Vedas a student would have to cram 10,521+ 1,975 + 1,875 + 5,977 = 20,348 mantras (including some common mantras) in the same sequence as presented in the Vedas – a very difficult challenge indeed! Those who completed the task of learning by heart the 20,348 mantras from the four Vedas earned the high revered title of Chaturvedi. Likewise, the surnames of Trivedi and Dwivedi were conferred for mastering respectively three and two Vedas. Those who carry such surnames are the descendents of learned ancestors.

The strong emphasis on oral tradition of learning prevailed in the Vedic society for several good reasons and it continues in the present-day *guru-kulas*. A good reason is that the oral learning allowed a student or a teacher to carry a book in his/her mind and not in his hand. This practice also enabled a quick retrieval of a mantra or a reference to advance a discussion on a subject. The practice of having the Vedic text in a *rishi*'s memory was like having a powerful living and mobile computer from which the desired mantras or *sutras* accessed sequential or at random. Just as in the modern computer age, the recalling of references requires computer hardware or a hardcopy of the required information, the *rishis* in ancient times also knew the importance of preparing the hardcopy of their thoughts. They certainly wrote their thoughts down on writing media in a well-developed script and initiated a tradition to carry the script-writing practice forward for the future generations.

A civilization may erect material monuments to display and preserve its history. Some monuments go back millennia in the past. A monument being a material manifestation of the science and culture of the society, it is primarily the subject of the sense of seeing. Another civilization may go beyond a proud display of material objects and instead lay emphasis on the

writing of the books of wisdom. The books of the Vedas for the ancient Aryan society are a manifestation of the pinnacle of intellectualism and spiritualism. When it comes to determining the age of a civilization, both, the material monuments and the books furnish information on the age of the civilization. In the case of a material monument, the legends and the written history about it and the carbon-dating would lead to its age. In the case of a book, the linguists would carefully study the parameters and applicable historical references to determine its age. The contents of a book itself may reveal the way of life and thought pattern of the people of that era. A necessary condition for the accurate determination of the age of a book from its text is to have the thorough knowledge of the language of the text and the history and culture of the society to which the book belongs. The Vedic civilization emphasized the pursuit of philosophy and spirituality. The Veda books and the books of the Vedic Literature in general are the spiritual monuments that the *rishis* left behind. The mantras are the invariant building blocks of this spiritual monument that do not decay with time.

Along with inventing a script and carrying out the writing work, one needs a medium for writing. One can start with the engraving on stone and etching on metal plates, but one cannot go too far with that. To write books and to keep written records, one needs paper and ink; barring the digital (virtual) copies. The ink is relatively an easy item to extract from vegetation while the process of producing paper was yet to be invented. It is said that the Chinese invented paper in 105 CE. However, the records of the foreign travelers to India during the period of Alexander-the-Great in the 4$^{th}$ century BCE express that the Indian businesspersons kept business transactions written down on paper locally available. If the Aryans had the writing tradition but had no paper until 105 CE, how did they carry out the writing of the vast Sanskrit Literature? This question is addressed in the following.

## Writing Medium in the Aryan Civilization

The generic term for a writing medium in Sanskrit language is *patra*. The word *patra* means a thin flat surface like a leaf. For that matter, a sheet of paper for writing and printing is a *patra*. Several writing media have been used by the ancient Aryans, most popular being the *bhoj-patra, taad-patra, kapaas-patra* and *resham-patra*. According to an ancient tradition in Vedic Culture when a king or the society venerated a person, a plaque made of a thin copper sheet was presented with the distinction engraved (etched) on it.

Such a medium of writing for important occasions is termed as *'taamra-patra'* (copper-paper). Therefore, while a *patra* means a leaf it also signifies a thin flat writing medium.

There is a common expression in contemporary Indian society that the ancient Aryans used to write on *bhoj-patra*. In this context, the *bhoj-patra* is not the leaf of the *bhoj*-tree. A *bhoj-patra* is a thin layer of the *bhoj*-tree's bark. In the case of a *taad-patra,* however it is not the bark of the *taad*-tree (palm-tree) but the broad leaf of the *taad*-tree. The writing of government land records on a thin pressed cotton-sheet (*kapaas-patra*) or on silk cloth (*resham-patra*) has been an age-old practice in the Indian countryside. Indelible ink was used on these mediums to prepare land ownership records with descriptive survey diagrams to preserve them for centuries. The village councils in south India, as late as the end of the twentieth century, still kept land records on *resham-patra* in parallel with the paper work. In case of the renewal of land records or the land-dispute, the village *patwari* (land officer) would bring out his land register containing land records written in black indelible ink on thin semi-transparent silk-cloth. Such old records with the village *patwaris* have served as the basis for the current land-data-base under the present state governments. This author has witnessed a *patwari*'s register and has acquired land-ownership records on silk-cloth for the land owned by the previous generation in the family.

In the context of the Indians keeping good records, Max Muller in the VII chapter of his book 'India-What Can It Teach Us?' has stated a historical fact related to Alexander-the-Great. Alexander's admiral named Nearchus sailed down the Indus River in 325 BCE. Records show Nearchus stating that when he frequented the maritime stations of India he met Indian merchants, who for commercial contracts and documents '*wrote letters on cotton that had been well beaten together*'. Three facts emerge from Max Muller's writing. First - the script existed in India in the fourth century BC; second - the writing was quite prevalent down to the level of business transactions; third - the Indians wrote on paper made out of cotton. Max Muller usually contradicts himself!

Before the invention of mass printing, the *bhoj-patra* was in ancient times an inexpensive medium for writing, which nature provided in abundance. Depending on the specific application, the *bhoj-patra* in varying bark thickness could be retrieved for writing; from a few millimeters down to thinner than regular printing paper, with a natural smooth surface quite

like paper. Most gurus in ancient India lived in ashrams in forests. When a guru assigned a student to take up serious writing work for preserving a text, the student would go out and collect the naturally peeling off bark of a *bhoj*-tree or retrieve from the naturally fallen *bhoj*-tree. A *bhoj*-tree is Betula Utilis or Himalayan Silver Birch tree. One finds several separable laminations under the outer rough white surface of the unrolled birch bark. When the outer layer is peeled off, four to six successive layers of the bark underneath are quite smooth for writing. This bark is much stronger than a printer paper of the same thickness. A *bhoj*-tree (silver birch) sheds its bark naturally. This enabled the ancient *rishis* to do their writing work on *bhoj-patra* without affecting the health of a tree. In the present method of producing paper, the death of a tree is inevitable.

To demonstrate a sample of Sanskrit writing in a way quite similar to the ancient Vedic times, this author has hand-written the two earlier cited mantras (RigVeda, 6,53/7, RigVeda, 6/53/8) on bhoj-patra. To integrate this writing into the text of this book, the author has included the scanned portion of the hand-written mantras. The original handwriting is on the third layer from the outer white rough bark of *bhoj-patra*. The difference here of course is that these mantras are written on a *bhoj-patra* retrieved from a Canadian birch and not from a Himalayan birch. The thin laminae that one peels off from a piece of the naturally separated bark of the birch-tree are not only thinner than the regular printer paper but they are also waterproof to last longer than a regular sheet of paper. The shade of the successive lamina changes from brown to a cream color providing good contrast for the black ink as shown above in the two printouts. One could use thicker laminate of *bhoj-patra* to preserve a manuscript for centuries. As mentioned earlier, it was the physical form of RigVeda Samhita's transcript, hand-written on *bhoj-patra* by Acharya Sayana, sometime in 14$^{th}$ century that Max Muller received in England for his English translation of RigVeda.

## Record-keeping and History Writing in Ancient India

The nineteenth century effort by the Western Indologists and neo-Sanskritists to rewrite the ancient history of India generally excluded the historical existence of kings like Vikramaditya after whom the Vikram Calendar began 57 years prior to the Common Era Calendar of the West. They also excluded the other kings who ruled millennia prior to Vikramaditya; to name a few here - Manu of Manusmriti, Rama of

Ramayana, Krishna, Yudhishthir and Arjun of Mahabharata (texts listed in Table 4.1). For the Aryans (Hindus) of India, all these kings of the past have been part of their glorious ancient Indian history. Influenced by Puranik mythology, the Western Indologists deemed these significant persons of history as fictitious and mythical characters. The historical accounts in Ramayan and Mahabharata and the recorded genealogies of kings preserved in Sanskrit Literature were also deemed fictional. With such a starting premise there was hardly any substance left for anyone to write about the ancient history of India except to talk about the invasion of India by Greeks, Muslims and Huns. The fact is that compared to the long ancient history of the indigenous Aryans of India, the invasions by the outsiders and their rule over India, are relatively recent. Even during the foreign rules, the ongoing ancient practice of record-keeping throughout India remained independent and unaffected.

To get to know about the history and record-keeping practices in ancient India, one had just to read the available accounts of the foreign travelers and visitors to India. Max Muller in the first chapter of his book – 'India- What Can it Teach Us?' has narrated from the second century writings of Arrian, the pupil of Epictetus, on the practice of reporting administrative information by appointed public overseers and superintendents in ancient India:

| | | | A.D. |
|---|---|---|---|
| 1. | GUHIL (GUHDUTT) | 523 | 566 |
| 2. | BHOJ | 643 | 586 |
| 3. | MAHENDRA | 663 | 606 |
| 4. | NAG (NAGADITYA) | 683 | 626 |
| 5. | SHILADITYA | 703 | 646 |
| 6. | APARAJIT | 718 | 661 |
| 7. | MAHENDRA (II) | 745 | 688 |
| 8. | KALBHOJ BAPA RAW | 791 | 734 |
| 9. | KHUMAN | 810 | 753 |
| 10. | MATTAT | 830 | 773 |
| 11. | BHARATRIBHAT | 850 | 793 |
| 12. | SINHA | 870 | 813 |
| 13. | KHUMAN (II) | 885 | 828 |
| 14 | MAHAYAK | 910 | 853 |
| 15. | KHUMAN (III) | 935 | 878 |
| 16. | BHARATRIBHAT (II) | 1000 | 943 |
| 17. | ALLAT | 1010 | 953 |
| 18. | NARWAHAN | 1028 | 971 |
| 19. | SHALIWAHAN | 1030 | 973 |
| 20 | SHAKTIKUMAR | 1034 | 977 |
| 21. | AMBAPRASAD | 1050 | 993 |
| 22. | SHUCHIVARMA | 1064 | 1007 |
| 23. | NARVARMA | 1078 | 1021 |
| 24. | KIRTIVARMA | 1092 | 1035 |
| 25. | YOGRAJ | 1108 | 1051 |
| 56. | KARANSINGH | 1594 | 1627 |
| 57. | JAGATSINGH | 1709 | 1652 |
| 58. | RAJSINGH | 1731 | 1680 |
| 59. | JAISINGH | 1755 | 1698 |
| 60. | AMARSINGH II | 1767 | 1710 |
| 61. | SANGRAMSINGH II | 1790 | 1733 |
| 62. | JAGATSINGH II | 1808 | 1751 |
| 63. | PRATAPSINGH II | 1810 | 1753 |
| 64. | RAJSINGH II | 1817 | 1760 |
| 65. | ARISINGH II | 1829 | 1772 |
| 66. | HAMIRSINGH II | 1834 | 1777 |
| 67. | BHIMSINGH | 1885 | 1828 |
| 68. | JAWANSINGH | 1895 | 1838 |
| 69. | SARDARSINGH | 1899 | 1842 |
| 70. | SWAROOPSINGH | 1918 | 1861 |
| 71. | SHAMBHU SINGH (ADOPTED) | 1931 | 1874 |
| 72. | SAJJAN SINGH (ADOPTED) | 1941 | 1884 |
| 73. | FATEH SINGH (ADOPTED) | 1987 | 1930 |
| 74. | BHUPAL SINGH | 2012 | 1955 |
| 75. | BHAGWAT SINGH (ADOPTED) | 2041 | 1984 |

**Udaipur Dynasty: Continuous record from 566 AD to 1984 AD**

"*They oversee what goes on in the country or towns, and report everything to the king, where the people have a king, and to the magistrates, where the people are self- governed, and it is against use and wont for these to give in a false report; but indeed no Indian is accused of lying*."

Although Arrian's above account is from the second century CE, the practice of reporting to the king and magistrates is a very ancient practice in India. Such a practice could be meaningful and sustainable only when a script existed in the society. Writing in a script and writing of the history had been a prevalent cultural practice in India from ancient times.

Old genealogy records of the dynasties of kings in different regions of India are still preserved. Writing and recording the history is not an imported

practice in India. They are a result of the indigenous practice ingrained in the Indian civilization. A few examples of such ancient historical records are given here.

Based on a book written in 1725 CE the unbroken record of genealogy of the Aryan kings who ruled from Indraprasth (Delhi), going back right up to the Emperor Yudhishthir in 3140 BCE were presented in Table 3.3 in Chapter 3. Also discussed in Chapter 3 is the history book entitled Rajtarangini, written in 1148 CE by Kalhan that takes us three millennia BCE detailing the genealogy of the Kashmir dynasty.

An example of a continuous *vanshavali* (genealogy) record, going back from the present time to 566 CE over 76 rulers of the Mewar Kingdom, is painted on the entrance wall of the Udaipur Palace in Rajasthan, India. This author has truncated the list for brevity. Before the British introduced the Common Era Calendar (CE) in India, the dating of written work including *vanshavalis* was carried out in one of the ongoing Indian *samvats* (calendars) discussed in Chapter 3. The Udaipur *vanshavali* begins with the first king Guhil (Guhdatt) who established the Kingdom of Mewar in the year 623 of Vikram Era calendar (566 AD). The painted genealogy of the Mewar kings presents the serial number, the name, the year of coronation and the number of years of that king's rule (not shown in this table). The Common Era year (A.D.) shown in this genealogy was added in recent times by the palace record keepers for the benefit of the tourists. Udaipur is one of the most frequented tourist spots in present day India. The fact remains that such a record will not go on a wall without it first being recorded in a ledger. Such a detail was not possible without having a tradition of written history. Not only the record-keepers of the kings preserved the records, the temples also independently maintained ledgers. These records have remained uninfluenced by the foreign rules or by the British methodology of record-keeping.

Maintaining historical records is a common practice all over India. The record-keeping continues at all levels of the Hindu society, from the kings to the common people. A simple example of common record-keeping is the preparing of the birth certificate. When a child is born in the present developed Western civilization, the birth certificate records the child's name, parents' names, place and time of birth. These details are also recorded in child's *'janm-patra'* (birth certificate), however, they are complemented with the astronomical data as well. A geometrical chart is drawn on the *'janm-*

*patra'* that provides the planetary positions at the time of the child's birth. To top it all, the birth constellation of the child is also recorded. The birth constellation is one of the 27 constellations named indigenously in Sanskrit and it indicates the Sun's position in the ecliptic when the child is born. The present astronomical nomenclature for all constellations used in such preparations is the same as the one given in the AtharvaVeda, discussed in Chapter 11 Volume 2.

About two thousand years ago, the practice of fatalistic astrology crept into the art of preparing the *janm-patra* of the newly born. Those who prepared the *janm-patra* charged money to interpret the supposed effect of the planets on the newly born and performed *pooja*, a ritualistic ceremony, to reduce the adverse effect of the planets. Regardless of such astrological practices, the process of writing and maintaining of birth records has been a very beneficial tradition in the Indian civilization. Of course, the uneducated farmers did not worry about getting the *janm-patra* prepared.

The process of record-keeping was not limited to a locale; it extended even to far-away places of pilgrimage that connected India from the north to the south and from the east to the west. Remarkable about these specific pilgrimage places is the ancient practice of writing down a pilgrim's name, place and date of pilgrimage along with the amount of donation given to the brahman priest performing the ceremony to bless the pilgrim. These records continue to exist since centuries.

The *rishis* in ancient times introduced the practice of going on pilgrimage to holy places. The *rishis* in their wisdom established places of pilgrimage at the extremities of the country and advised people to travel to these places. The multiple benefits of undertaking a pilgrimage were obvious. It kept the history of the holy place alive and a pilgrim got to know the geography of the country and became familiar with different customs of the inhabitants in different parts of the subcontinent.

This author recalls vividly his visit as a child along with his parents to the pilgrim place called Haridwar at the foothills of the Himalayas on the banks of the River Ganga (Ganges). It was during the mid-1940s when India was about to get freedom from the British Raj. As we got off the train at Haridwar, a representative from the Haridwar priestly community greeted us. He asked for my father's name and place of birth. Right away this representative steered us to a small office where a priest sat in the lotus position at a slanted writing desk. The priest welcomed us, asked us to sit

down and declared that he and his ancestors have been our family's priests for many generations during the pilgrimage journeys to Haridwar. He performed a short worship service by reciting mantras for the successful completion of our family's pilgrimage. Then he asked a young priest to hand him a specific register related to our district and our family. He opened the register and started reciting the genealogy of my family like a passage from the scriptures, going back many generations. This monotonous recitation included the names of my grandfather and great grandfathers, the dates of their pilgrimage in Vikram-calendar (Hindu calendar) and the amount of donations received. My father gave the priest some cash donation and we left for a dip in the River Ganga. I heard my father telling my mother that as far as he could recall the priest's recitation of our family genealogy was flawless.

The priest did not render special treatment to this author's family because our ancestors were privileged people or from a big town. The fact is that this author's parents and ancestors have been the residents of a small village that is several thousand years old, in the state of Rajasthan, some 500 km from this pilgrim place at Haridwar. Nevertheless, the practice of recording the dates of pilgrimage continues even now with the difference that the amount of donation to the priest is probably inflated and the record-keeping probably is computerized.

The practice of record-keeping is ingrained at all levels of Indian culture.

## European Scholars on the Age of the Vedas

Historians have used several methods to estimate the age of the ancient civilizations, cultures, monuments and literature. There are several different methods utilized by the historians for differing subjects:

(a) Mythological Method compares the different mythologies to ascertain their period of development.

(b) Antiquarian or Historical Method examines and interprets the ancient records at hand to ascertain a historical period.

(c) Contemporary Method establishes a succession period of specific literary works by fixing their individual dates (period).

(d) Scientific Method subjects the ancient article to laboratory testing, conducts an analysis of the scientific data in the areas of astronomy, geology,

chemistry, ecology, satellite observations, the genome studies and so on.

European scholars have utilized different applicable methods to determine the age of the Vedas that led to a wide range of inconclusive estimates.

## Mythological Method and Puranas

An implicit assumption in applying the Mythological Method on the timeline of a society is that a society begins with myths and blind-beliefs that diminish with time when education and science increase. An attempt to trace back the timeline of a developed society may lead to the beginnings of that society. While there is no difficulty in accepting that education and science eradicate myths and blind-beliefs, the difficulty is in accepting that the timeline of a society is a bi-ended straight line, with the primitive state of the society at the first end and the developed state at the second. In this author's view, it is a curve with peaks and valleys rather than a straight line; peaks at the height of civilization and the valleys when the society is saturated with ignorance, myths and blind-beliefs. A society that once was at the cusp of civilization with a high level of education could go down into an abyss with time, the causes being external invasions, internal degradation or nature's calamities. The same civilization could rise again. To judge a society's up and down over a span of five-six millennia is not logical because the intelligent humans according to anthropology have been around at least a quarter of a million years.

An examination of the Vedic culture tells us that the Vedas have existed in the Hindu society first and have no mythology in them. The other major literary works based on the Vedas, written in the Aryan society of India prior to and up to the Mahabharata period 5,000 years ago, such as from the Upanishads right down to the six Darshans, have no trace of mythology in them. The mythology in the Hindu society begins after the society went through a dark period during a millennium or two after the Mahabharata War when the education in the society declined. The mythological stories took firm hold after the Puranas were written from about 500 BCE. This was also the time when the form-worship was introduced by Buddhism and Jainism to worship respectively the Buddha and Teerthankars when the priestly brahmans followed suit to counter the conversion of Aryans/Hindus to these two religious disciplines, which according to the Vedic philosophy, were

atheistic. Aryans/Hindus also began building temples with their own deities in them. Archeological excavations reveal that even the most ancient Hindu temples are younger than about two and a half thousand years. The process of creating mythology continued in the Hindu society for a thousand years after the beginning of the Common Era when it became a part of Hindu life. In the present Hindu society, one would find both kinds of people, having a highly philosophical approach to religion without believing in the myths and those believing in myths, ghosts, animal sacrifice and so on. Therefore, the age of a society's literature cannot be determined only by the rate of decline of the mythology and the onset of scientific progress. From the study of human history, be it of Vedic India or of the Egypt of the Pyramids, one can observe that the cycle of progress and decline of societies is a long-term oscillatory phenomenon.

## Antiquarian (scientific), Antiquarian (Historical) and Contemporary Methods

The Antiquarian Scientific Method when applied to a hardcopy of a manuscript of the Veda, hand written on *bhoj-patra*, would yield the age of the manuscript and not of the Veda. The Antiquarian Historical Method of crosschecking for the references of the Veda in other Vedic Literature indicates clearly that the Vedas are mentioned in other books and commentaries on the Veda mantras but in the four Veda books, no other books are mentioned. Historically speaking, the deduction drawn is that the Vedas are from an era long before the other books from the ancient past of the Indian Aryan Civilization. The Contemporary Method required a thorough knowledge of the Vedas and the Vedic Literature. The Western scholars of that time were thronged with pre-conceived notions and prejudices about the Veda and the post Vedic Literature.

Observing the mediocrity in applying the Antiquarian and Contemporary methods to determine the succession period in Vedic Literature, Pundit Guru Datta noted in "The Terminology of the Vedas and the European Scholar" (1880 CE): -

> "*One is indeed wonderstruck at the way in which European scholars mistrust Indian chronology, and force their hypothetical guess work and conjecture before the world as a sound historical statement of facts. Who, that has impartially studied the Darshan literature, does not*

*know that the Darshans existed centuries before even the first word of Buddhism was uttered in India? Jaimini, Vyas and Patanjali had gone by, Gautama, Kanada and Kapila were buried in the folds of oblivion when Buddhism sprang up in the darkness of ignorance. Even the great Shankara, who waged a manly war against Buddhism or Jainism, preached nearly 2,200 years ago…Further, there is no event as certain in Indian History as Mahabharata, which took place about 4,900 years ago*."

The six names in this quotation are those of the authors of the six Darshans (Table 4.2) that precede the great war of Mahabharata. The cross-referencing studies in Sanskrit Literature by contemporary Indian Sanskrit scholars (i.e. application of Antiquarian/Historical and Contemporary Methods, e.g. Pundit Udayaveer Shastri) establish that the other branches of Vedic Literature (items 1 to 7 in Table 4.1) preceded the six Darshans (item 8). Going deeper into Vedic philosophy one gets the revelation that the manifestation of the Darshan *sutras* and their structure had an underlying process that required the pre-existence of their source. Undisputedly, the four Vedas are the source of the six Vedic Darshans and all the other post-Vedic literary works listed in the Tables 4.1 and 4.2. The interpretive exposition of the Veda mantras in the books of Brahmanas and a foundational discussion in the Upanishads were a prerequisite for the development of the Darshans. Glimmering through the sutras of the Darshans are also the principles laid in the Smritis.

The 'great Shankara' in the above quotation is Aadi Shankaracharya who established the five Mathas (monasteries) between 499 BCE and 482 BCE in the five regions of India. A detailed discussion on Aadi Shankar was presented in Chapter 3. The period of Aadi Shankaracharya is highly relevant to the state and the fate of Budhism in India. The written historical material preserved in these monasteries is one of the best possible evidence for the Antiquarian and Contemporary methods. The European scholars hardly touched this material before they hypothesized about the history of the Vedic Literature or hypothesized about Aadi Shankaracharya's period. Those Indian scholars who tooted the horn of the European scholars also overlooked this valuable well-preserved and protected historical material in the Sanskrit language. Acharya Udayaveer Shastri (cited earlier) researched the Matha literature arduously while staying at the monasteries. The results of his studies in Shankaracharya monasteries were presented in Chapter 3. In

the same chapter are also discussed the findings based on the Scientific Method that include the evidence related to astronomy, geology, ecology and the state of the art genetics, all of which place the Aryans, their culture, language and religion way back in the antiquity of modern human development.

Guru Datta in the above quotation over a century ago did not pull out of a hat the number 4,900 years for the historical time of the Mahabharata War. He based that time on the historical accounts from the ancient Indian literature and he questioned the *European scholars' mistrust in Indian chronology*. Swami Dayanand Sarasvati and Guru Datta Vidyarthi pointed out independently in differing ways, the basic flaw in the Europeans' approach to determining the age of the Veda but their advice went unheeded. On this subject, Max Muller had put forward several self-contradicting hypotheses.

The real milestones of the Vedic Civilization are the books listed in the Table 4.1. To apply the Contemporarian Method to these books, one has to be able to read and understand the written material in them and the written commentaries on them. Learning to read Sanskrit is not sufficient to understand the meaning of the writings on these milestones. For example when one is looking for a milestone such as the 'Six Vedic Darshans' (Table 4.2) one will find that they are six different milestones separated in time. When one arrives at one of these milestones and begins to read the *sutras* in it, one may not be able to apply the Contemporarian Method to determine the dates of their creation. The ill preparedness of the Indologists meddling in the Indian history and the history of the Sanskrit Literature is summarized by a well-known incident in Max Muller's life (noted from "Early Indologists & Indology of India, PART 2; by Swami B. V. Giri):

> *A brahman student from India went to England. When he heard that a great Sanskrit scholar named Max Mueller taught at Oxford University, he went to meet Max Mueller. When he came face to face with Mueller and spoke to him in chaste Sanskrit, Professor Max Mueller was dumbfounded, unable to respond. Mueller admitted that he could not understand 'what the gentleman was saying'*!

Based on Max Muller's mantra translations, his contemporary in India, a monk with mastery over the Sanskrit language and having immense Vedic knowledge, Rishi Dayanand Sarasvati observed that Max Muller had

indulged in distorting the meaning and the knowledge in the mantras. In his book Satyarth Prakash, he compared the Sanskrit ability of Max Muller to - *'a toddler learning to walk'*.

About the same time the German philosopher Arthur Schopenhauer (1788-1860), who had studied the Upanishads well, also cast doubt on the ability of the Westerners claiming authority on Sanskrit. He noticed that neo-Sanskritist Europeans were meddling amateurishly in determining the age of the Vedas.

Swami Dayanand Sarasvati advised the Indologists and neo-Sanskritists where their deficiencies lay in translating the mantras. One simple example of a deficiency pointed out by Swami Dayanand was their ignorance of the elementary rule of Sanskrit grammar in the usage of singularity and plurality. These Indologists had not learned that in addition to a singular form of a word there were two plural forms of the word – dual plural and multi-plural. Max Muller while translating mantras had treated a dual-plural as plural causing distortion in the meaning of the mantra.

While translating the very first mantra of RigVeda and its first word *agni* in particular, Swami Dayanand Sarasvati gave references of several other mantras in the Vedas and the ancient statements from the Shatpath Brahmana, Nirukt and Manusmriti. He emphacized that the word *agni* stands for two meanings respectively in the spiritual and the physical realms and the context decides which meaning applies. A Veda mantra may at times have two meanings valid for each realm. It is under a specific poetic-adornment rule in Sanskrit called the *'shlesha-alankaara'*, a unique beautiful feature of the Vedic Sanskrit poetry when a single mantra renders more than one meaning, both valid. Swami Dayanand Sarasvati in his Hindi translation and commentary of the RigVeda pointed out, in the first few pages, that the Western Sanskritists and scholars of Indology namely Wilson and Max Muller did not understand this multidimensional poetic adornment. The consequence was their erroneous translation of the Veda mantras. The very first word of the very first mantra of RigVeda, the *agni*, remained beyond their grasp of understanding.

Swami Dayanand Sarasvati said that to understand a Veda mantra, having some vocabulary of the Sanskrit language, a handy Sanskrit dictionary and just being able to read the rules of Sanskrit grammar were not sufficient. One had to understand and learn the required methodology emphasized in the Vedic Literature by the ancient *rishis*. One had to

understand the books of Brahmanas, the logic of the language, Vedic Sanskrit grammar (Rishi Paanini's Ashtadhyayi), understand Vedic terminology (Rishi Yask's Nirukt and Nighantu), other educational tools and finally understand the context of the mantra itself. However, the Indologists ignored his advice. Observing such a state of affairs Swami Dayanand Sarasvati expressed his opinion in the 11th chapter of Satyarth Prakash (1881 CE) as in the following (translation taken from Guru Datta Vidyarthi):

> "*The impression that the Germans are the best Sanskrit scholars, and that no one has read so much of Sanskrit, as Professor Max Muller, is altogether unfounded. Yes, in a land where lofty trees never grow, even a ricinus communis or the castor-oil plant may be called an oak. The study of Sanskrit being altogether out of question in Europe, the Germans and Professor Max Muller may there have come to be regarded as highest authorities….I came to learn from a letter of a Principal of some German University, that even men learned enough to interpret a Sanskrit letter are rare in Germany. I have also made it plain from the study of Max Muller's "History of Sanskrit Literature" and his comments on some mantras of the Vedas that Professor Max Muller has been able only to scribe out something by the help of the so-called tikaas, or paraphrases of the Vedas, current in India*."

Some Western and Eastern scholars have drawn clues from the Veda mantras for quick and easy conclusions to establish the historicity of the Vedas. However, such clues have not yielded sound conclusions. Their ill-fitting linguistic clues were based on choosing certain words that appeared in some Veda mantras. One such word is *manu*. *Manu* is also the name of a king, the author of Manusmriti and the king who established the city of Ayodhya. Their argument was that because the term *manu* exists in the Veda, the Vedas have history in them and without any further historical analysis Max Muller baselessly hypothesized that Manusmriti was written probably after 400 BCE and therefore the Vedas must have been written in not too distant a past from that period. Swami Dayanand has provided the meaning of the term *manu* and explained how it is derived from the "*munn gjyane*" *dhaatu* (root) for "*to think*". God is addressed as Manu because "*His knowledge is His glory*". In the context of a Veda mantra the term *manu* is for the "*all-accepting Creator*" and not a person named Manu who became a king. Not understanding the context of why the term *manu* appeared in the

mantra and what its *yaugik* meaning is, the wrong conclusions were drawn by Max Muller and others about the historicity of the Vedas.

## Vedic Principle for the Age of the Vedas

The Vedas neither have in them any specific calendar date for their creation nor do they carry any human history. They just have the formulations of thought, called the mantras. The Big Bang cosmologists believe that as soon as the process of the creation of the universe began and the matter started to form, the gravitational field started to coexist with matter as the property of matter. They label the gravitation in matter as an 'inherent property of matter'. In a similar way the Vedas emphasize that the knowledge is also an 'inherent property of the creation', available for living beings to tap into at will. The level of acquisition of this knowledge is however according to the ability and predisposition of the living being. This predisposition of a living being depends on its physical and spiritual evolution acquired through the karmic cycle. The Vedas for the Aryans of India are the revelation of knowledge, the term for which in Sanskrit is *gjyan*. The *gjyan* according to the Vedas and the Vedic philosophy is one of the properties of the universe (Nature) that has a relationship and interaction with conscious-beings and is not merely a chemical process in a living-being's brain. What mass is to matter the *gjyan* is to consciousness. Just as many entities and phenomenon of eternal and transient nature, such as Time, Space, energy, gravitation in matter and so on are revealed at the onset of creation, the *gjyan* energy field is revealed through the consciousness in life forms. It is an energy field unto itself that emanates from the all-pervading consciousness field called God; it persists through the universe to be availed by a conscious-being individual soul, according to the soul's preparation. This preparation is the soul's ability to acquire *gjyan* (knowledge). *Gjyan* begins emanating from the time zero of the creation and therefore assigning an age to it is the same as assigning an age to Time or assigning an age to the gravitational field of the universe. At the end of creation, the field of *gjyan* energy, along with all forms of matter and energy (Nature) retract back into their source, the Creator energy field. This is a short explanation without invoking details of the Vedic philosophy for the Vedic connection between the consciousness and the *gjyan* (knowledge)

It is natural to think that this concept of knowledge and its origin is un-provable and therefore a self-serving hypothesis. Fair enough. However, this

human limitation is not limited to philosophy it is also a drawback of Big Bang Hypothesis as well. A hypothesis enables a beginning point for the search of knowledge, be it in the realm of matter or of consciousness. Therefore, a hypothesis attempting to prove a phenomenon in the realm of matter is not fit to reject a hypothesis pertaining to consciousness.

As soon as matter manifests in the creation the mass appears in it, which creates the gravitational field that embeds the universe in it. In the Big Bang Hypothesis, there is the all-permeating gravitational field because there is matter in the entire universe. In the theistic Vedic thought, there is the ubiquitous knowledge (*gjyan*)-field because there is the all-pervading Creator-energy field with the additional property of consciousness. In the Vedic concept of *gjyan* the consistency of logic would require that the knowledge field existed from the beginning of creation because for the Vedic concept the Creator entity exists from the beginning of creation. This is what the Vedas propound, the Upanishads explore and the Darshans conclude in their *sutras*.

No living creation can begin and survive without the spark of knowledge appearing in a living being. Therefore, the Aryans believe that because the knowledge exists from the very beginning of the universe, the Vedas are present right from the beginning of creation. The soul, a localized formless quantum of consciousness in a living physical body, endeavours through the physical body equipped with knowledge gathering functions. For the emanating Creator-energy knowledge-field, each soul serves as a reception antenna receiving the level of knowledge according to its own reception ability. This ability is a function of the soul's *karmic* balance. It is an antenna's attribute to intercept and receive the signal. The formless quantum of soul also has the attribute of interacting with matter to form its physical/biological body for implanting the knowledge senses. It is through the physical/biological body, equipped with the knowledge senses, that the soul transforms the formless knowledge into a visible script. This script in turn can manifest into a book.

When one goes beyond this abstract concept of knowledge and thinks in terms of the substantive form of the Veda, one begins to wonder at what stage of creation the Vedas came into the form of chapters (*mandalas*), sections (*suktas*) and verses (*mantras*). It is the physical form of the book or a manuscript that is generally assigned an age, 500 BCE or 1500 BCE as the Indologists did, erroneously. The presumption in assigning such dates is that

the knowledge contained in the mantras of the Vedas and the physical book of the Veda came simultaneously. This assumption however breaks down when one comes across the reference of the Veda in a book much older than previously thought. All books in the vast and ancient Vedic Literature, anterior to Mahabharata (in Tables 4.1 and 4.2) are based on the Vedas and are inundated with references of the Vedas but do not make a single mention of the age of the Vedas. One is amazed with the fact that not a single reference of any texts, manuals, notes or dictionaries is found in the Vedas that might have preceded the Vedas. We do not have a single book or even a single phrase that a historian could find which might have preceded the Vedas. A follower of the Veda cannot venture upon assigning an age to the knowledge (*gjyan*) field that persists from the beginning of the creation. That is why the common expression - *the Vedas are ageless*. This implies that they are from the beginning of the creation. Since the Vedic Civilization in India is very ancient and the invariant Vedas have been the fountainhead of knowledge for the Aryans of India, the Vedas are put in a category of revealed knowledge from the beginning of creation. The *gjyan* energy field ought to exist before the first conscious-being living cell is to appear in the creation and survive its next moment.

## Max Muller et al Credited and Discredited

There is no doubt that Max Muller's dedication to Sanskrit and the studies in Indology resulted in voluminous writing, over 3000 pages, covering the Vedic and Buddhist literature. He carried out editorial work on the RigVeda and the RigVeda *bhashya* (interpretive translation) from the original hand-written manuscripts that he received from India. He also wrote several books on the Vedic religion and culture. Many people in the literary field are in high admiration of him including some scholars of Indian origin who have even called him a *rishi*. Obviously, these scholars have no literary knowledge of the definition of a *rishi*. A *rishi* by definition is the '*revealer of the mantras and their recondite knowledge*' and not just a translator with a Sanskrit dictionary by his side.

Another writer called Max Muller the 'Vedvyas of Kaliyuga', Kaliyuga being the present era in the Vedic Calendar with onset on February 18, 3102 BCE. Rishi Vedvyas, the great philosopher and the author of the Vedanta Darshan (Brahm Sutra philosophy) and the book of Mahabharata cannot be

compared with mediocre translators of Sanskrit text. Just to name a few themes expounded in Mahabharata alone are politics, science, duty to society, social ethics, character-building and philosophy. Rishi Vedvyas was also the writer of the interpretive commentary on Yog Darshan. Rishi Vedvyas' positive effect on the mind of the Aryans is immense. Max Muller on the other hand has been instrumental in negating what Rishi Vedvyas stood for. Those who have called Max Muller with the superlatives of '*rishi*' and 'Vedvyas' must spend more time reading and understanding Vedic Literature and shake off the adverse effect of the educational scheme of Lord Macaulay, Max Muller and the British Raj.

Max Muller's dedication to his Sanskrit studies and Indology, as we understand from his life history, was to earn a high status of living and to uproot the Vedic religion, the religion that can claim to be universal. Any damage to the non-sectarian philosophy of the Vedas, with the message of universality, is not the damage to the Vedas themselves, because the Vedas are the invariants in time and space. The real damage is to the whole world and a great loss to all intellectuals and those striving for spiritual enlightenment free of the crutches and dogmas of sectarian religions.

References of King Manu, the codes and principles in his book of Manusmriti, inundate the book of Ramayan (too many to cite here). Five millennia ago Rishi Vedvyas' Mahabharata composition is inundated with references of Ramayan (Mahabharata-Shanti Parv, 11/20-24) and Manusmriti (Mahabharata-Shanti Parv, 13/35; 18/11 Anushaasan Parv, 12/15;….). Yet, Professor Max Muller states in the III chapter in his book - "India –What Can It Teach Us?" about the ancient book of Manusmriti:

> "*As to the laws of Manu, which used to be assigned to a fabulous antiquity, and are so still sometimes by those who write at random or at second-hand, I doubt whether, in their present form they can be older than the fourth century of our era, nay I am quite prepared to see an ever later date assigned to them. I know this will seem heresy to many Sanskrit scholars, but we must try to be honest with ourselves. Is there any evidence to constrain us to assign the Manavdharmasastra (Manusmriti), such as we know possess it, written in continuous slokas, to any date anterior to AD 300*?"

Max Muller in the above quotation imposes literary honesty on others and himself and says that Manusmriti could not have been written before

400 AD or 300 AD. Max Muller pulls both numbers out of his hat without furnishing any logical basis or a solid historical or literary reference, yet he had the audacity to challenge others to provide proof that Manusmriti was written before 300 AD. He obviously needed a lesson in logic. He ought to have provided some proof for his own dates before raising the rhetoric question in his quotation above.

Max Muller never visited India and India's literary institutions and he never developed the required foundation in Sanskrit grammar. He based his logic or lack of it, on his limited perspective developed in Oxford, England. He never subjected himself to even one *shastrarth* (a traditional literary and philosophical challenge/debate) to discover how far he was right or wrong. It would not be excessive to say that an old Sanskrit idiom applies to him - *koop-mandook*: a frog in a well that has little knowledge of what lies outside.

How could the simple logic escape him that in 326 BCE when Alexander the Great invaded India the orderly Indian society was already following Manu's laws from his book Manusmriti? The educated Indians commonly quoted Manusmriti and its *shlokas* and the Indian society was following the dharma based on the principles ascribed in Manusmriti. Max Muller himself writes in "India - What Can It Teach Us?" that "*Alexander stood speechless in front of the yogis and maneeshis…*". The *maneeshis* are the thinkers and followers of dharma, the dharma code of ethics that is based on *Manav-dharma-sastra* – the Manusmriti. Therefore, the book of Manusmriti had to be much older than 300 AD. Manu and Manusmriti are quoted in the books of Ramayan and Mahabharata. If Muller's logic were followed, then these two books would belong to a period after 300 AD. Absurd!

Max Muller's scholarship and professionalism are questionable. To get a clearer picture of his honesty and professionalism let us examine a few more of his statements. Why is the present author singling out Max Muller's incompetent work related to the historicity of the Vedas and his mantra translations? The reason is significant.

The primary aim of this book is to present the mantras on science thought and cosmology in the Vedas. The reader is going to find differences in the translations of the relevant mantras provided by Max Muller and this author. Most scholarly in the West and a large number of educated Indians unquestioningly accept Max Muller's conjectures about the Vedas and the Vedic Literature and his translations of the Veda mantras. The question is

whose translation is correct? To translate a mantra this author has first provided the *yaugik* meanings of all the terms first and the composite translation in English is constructed based on the Vedic methodology mentioned earlier. Max Muller has used *rudhi* meanings and provided composite translations that at times have no relation to the mantras and at other times are meaningless and weird. The reader will notice this fact when two translations are compared. A sample of Max Muller's nonsensical translation of a mantra is presented under the sub-heading "Max Muller's Scholastic Sanskrit Ability in Question" in the following where he wrongly translated 9 words out of about only a dozen in the mantra, RigVeda (1/162/2). In addition to the nonsensical translations of the mantras he is among the early Indologists who has done the most harm to the good name and the value of the Vedas and the Vedic knowledge. This author is making an effort to shake the negative impression that Max Muller has created all over the world with his well-publicized myths about the Vedic culture, Vedic history, Aryan invasion of India and Veda mantras, including those containing science thought and cosmology. This author's humble desire is to promote the *satya*, the 'truth' of the Vedas and question Max Muller's *a-satya*. The humble hope is for *Satyameva jayate*, meaning - *'only the truth prevails'*.

Max Muller did not consider withdrawing the erroneous translations even when pointed out. Many contemporary authors in the arena of Vedic writings (Swami B. V. Giri, Swami Vidyananda Sarasvati), who are referred to in this text, have carried out thorough research in the literature on Max Muller and presented quotations from Max Muller's books and letters that he wrote. This author has cited in the following just a few quotations from the published literature (see Ved Meemansa, publ. 1984 and Aryon Kaa Adidesh aur Unki Sabhyata, publ. 1989, by Swami Vidyanand Sarasvati).

After Max Muller learnt Sanskrit and carried out some translation work in Germany, he went to England at the age of 23 in search of a job. There he met Lord Thomas Babington Macaulay (1800-1859 CE), a member of the Supreme Council of India representing the British government in British India. Macaulay was in the process of implementing the British Education Plan for India. Soon after his arrival in 1834 CE, Macaulay commissioned Max Muller to translate the main religious book of the Hindus, the RigVeda, into English at a rate of 4 shillings per page. After that, he was appointed at Oxford where he translated and wrote many books on Vedic culture, Vedic

Literature and Buddhist philosophy. Max Muller is therefore considered the champion for popularizing the Indian wisdom contained in the Vedas and the philosophies based on the Vedas. His letters to different people are available in printed form and tell us about his true state of mind. Following are some excerpts from 'Life and Letters of Fredrick Max Muller'.

(A) From his speech at the Christian Missions in Westminster Abbey in 1873:

> "*Hinduism was dying or dead because it belonged to a stratum of thought which was long buried beneath the foot of modern man… The worship of Shiva, Vishnu, and other popular deities was of the same and in many cases of a more degraded and savage character than the worship of Jupiter, Apollo or Minerva. A religion may linger on for a long time, it may be accepted by large masses of the people, because it is there, and there is nothing better. But when a religion has ceased to produce defenders of the faith, prophets, champions, martyrs, it has ceased to live, in the true sense of the word; and in that sense the old orthodox Brahmanism has ceased to live for more than a thousand years*."

His first sentence in the above quotation that "*Hinduism was dying or dead …long buried beneath the foot of modern man…*", is in direct contradiction with his assertion in the third chapter of his book, 'India - What can it Teach Us?' where he said, "*I shall say even more, and I have said it before, …we can hardly understand how, at so early a date, the Indians had developed ideas which to us sound decidedly modern*".

(B) To his wife in 1866 about the translation of RigVeda and the Vedic religion:

> "*This edition of mine and the translation of the Veda will, here after, tell to a great extent on the fate of India and on the growth of millions of souls in that country. It is the root of their religion and to show them what the root is, I feel sure, is the only way of uprooting all that has sprung from it during the last three thousand years"*. ('Life and Letters of Fredrick Max Muller', vol. I, chap. XV, p.34.)

(C) To the Duke of Argyle the Governor of India in 1868:

"*India has been conquered once, but India must be conquered again and that second conquest should be a conquest by education…the ancient religion of India is doomed, and if Christianity does not step in, whose fault will it be*"? ('Life and Letters of Fredrick Max Muller', vol. I, chap. XVI, p.378).

(D) E. B. Puse a friend from Oxford wrote to Max Muller:

"*Your work will mark a new era in the efforts for the conversion of India"*.

(E) In 1876, while writing to a friend, Max Muller said that he would not like to go to India as a missionary because that would make him dependent upon the government. His preference was this -

"*I would like to live for ten years quite quietly and learn the language, try to make friends, and then see if I was fit to take part in this work, by means of which the old mischief of Indian priestcraft could be overthrown and the way opened for the entrance of simple Christian teaching…India is much riper for Christianity than Rome or Greece were at the time of Saint Paul*".

"*The rotten tree for some time had artificial supports ...but if the English man comes to see that the tree must fall...he will mind no sacrifice either of blood or of land...I would like to lay down my life, or at least lend my hand to bring about this struggle*"… "*I do not claim for the ancient Indian Literature any more than I should willingly concede to the fables and traditions and songs of savage nations. I simply say that in the Veda we have a nearer approach to a beginning, and an intelligent beginning, than in the wild invocations of the Hottentotes and Bushmen,..*"

(F) Max Muller wrote and exhibits his arrogance towards an Indian intellectual, N.K. Majumdar:

"*Tell me some of your chief difficulties that prevent you and your countrymen from openly following Christ, and when I write to you I shall do my best to explain how I and many who agree with me have met them and solved them...From my point of view, India, at least the best part of it, is already converted to Christianity. You want no persuasion to become a follower of Christ. Then make up your mind to*

*work for yourself. Unite your flock - to hold them together and prevent them from straying. The bridge has been built for you by those who came before you. STEP BOLDLY FORWARD, it will break under you, and you will find many friends to welcome you on the other shore and among them none more delighted than your old friend and fellow labourer. F. Max-Muller."*

(G) Max Muller repudiates his own hypothesis:

Max Muller wrote for Anthropological Review in 1870 to popularize the Aryan Racial Theory where he had classified the human race into seven categories on an ascending scale - with the Aborigines on the lowest rung and the "Aryan" type at the top. Those who have studied his work, find that repeatedly he pulled self-contradictory theories out of his hat without any logical basis and his theory on the human race with an ascending scale, putting the Aryans at the top, was one such example. To save his reputation as a Sanskrit scholar who flunked in understanding the meaning of the Sanskrit term *arya* (for Aryan) which actually meant '*a person with noble qualities and character*' or the "*ishvar putra* (*progeny of God*)" without any connotation of race, color or physical stature, he recanted his earlier hypotheses stating:

"*I have declared again and again that if I say Aryan, I mean neither blood nor bones, nor hair, nor skull; I mean simply those who speak an Aryan language...to me an ethnologist who speaks of Aryan race, Aryan blood, Aryan eyes and hair, is as great a sinner as a linguist who speaks of a dolichocephalic dictionary or a brachycephalic grammar*".

Based on the quotations presented above one should have no doubt about the condition of Max Muller's mind. As Pundit Guru Datta Vidyarthi had said - *It is necessary that the mind should, by an adequate previous discipline, be raised to an exalted mental condition*,…So is it with Vedic philosophy; Professor Max Muller's mind was nowhere near an exalted state.

Max Muller wrote several books and articles on India including, 'Sacred Books of the East', 'Laws of Manu' (a book on Manusmriti), 'Sanskrit Grammar for Beginners in Devnagari and Roman Letters', 'The History of Ancient Sanskrit Literature', 'India - What Can It Teach Us?' and many more in addition to his multi-volume commentary and translations of Veda mantras. The entire writing work was undertaken ill prepared and with

a mind that was prejudiced with preconceived notions about the Vedic philosophy and infested with ulterior motives.

## Max Muller an Epitome of Contradictions

Max Muller in the first chapter of his book – 'India - What Can It Teach Us?' refers to the historical accounts of several foreign writers and travelers to India. For the excellence of the justice system in ancient India, he refers to Ktesias, the famous Greek physician of Artaxerxes Mnemon, who was present at the battle of Cunaxa in 404 BCE. His period overlapped with that of Megasthanese who was Seleucus Nicator's ambassador in the court of the Indian king Chandragupt of Pataliputra (Sandrocottus of Palibothra, in Greek). Ktesias was the first Greek writer who wrote a special chapter titled - 'On the Justice of the Indians'. He quotes from the writings of Megasthanese that in India of that time - '*theft was extremely rare, and that they honoured truth and virtue'*Ktesias's account of the excellence of the justice system in ancient India precedes the year 288 BCE which marks the death of the great Emperor Chandragupta Maurya. Max Muller also quoted from the second century writings of Arrian (86-160 CE) a Greek philosopher, historian and a military commander who was the pupil of the Greek Stoic philosopher Epictetus (55-135 CE). As cited earlier, Arrian wrote about the systematic work of public overseers and superintendents in India of that time.

Max Muller continues to shower praise for the honesty and integrity of the Indians of ancient times citing the records of well-known Buddhist pilgrim travelers from China, foreign Muslim writers after the Muslim invasion of India and the records of Marco Polo, to name just a few. As mentioned above, he cited Nearchus, the admiral of Alexander the Great, to have stated in 325 BCE that for commercial contracts and documents '*the Indians wrote letters on cotton that had been well beaten together*'.

Hence the big question is – if Max Muller found credibility in the accounts of foreign travelers to India, that the Indians had high honesty and integrity, why does he not trust the ancient accounts of history in the ancient Sanskrit writings that Indians wrote? It is strange behaviour on the part of Max Muller that he would mistrust the historical accounts laid down by the honest *acharyas* and *rishis* of the ancient Sanskrit texts, which said time and time again that Mahabharata took place over 3000 BCE and that the books of Ramayan and Manusmriti were even older, the Vedas being the oldest.

For these *acharyas* and *rishis*, the '*naanritam*' (truthfulness) was godliness and *asatya* (falsehood) was sin. Max Muller may not have understood Sanskrit and the Veda very well but at least he understood these values of the Aryans that he mentioned in his writings. He chose to mistrust the truthful scholarly people of India so that he could distort the ancient Indian history.

## Max Muller's Scholastic Sanskrit Ability in Question

Max Muller was aware of Swami Dayanand's RigVeda *bhasya* (translation) being published in installments in an Indian journal. It is also obvious from his comments that he had read Swami Dayanand's *bhasya*. Within the first few pages of his RigVeda *bhasya,* Swami Dayanand invoked several ancient references including the emphasis on Nirukt etymology and Ashtaddhyayi grammar. In the same first few pages Muller must have also read of Swami Dayanand pointing out the mistakes in the mantra translations of H. H. Wilson (1786-1860), Max Muller, R. T. H. Griffith (1826–1906) and Sayanacharya. Muller compromised little and rather dismissively commented on Swami Dayanand Sarasvati -*"He has done some new translations of Vedic words and mantras, but nothing that is not available in the old tradition, I have not found some demonstration of new thinking."*

Although Max Muller has mentioned Nirukt and Ashtaddyayi in his subsequent writings, it is obvious from his Veda translation that he did not understand them. If he had read them with good understanding, he would not have passed a derogatory comment on a profound scholar of Sanskrit, Swami Dayanand Sarasvati. The fact was that Swami Dayanand Sarasvati neither invented a single word of Sanskrit nor did he come up with an arbitrary meaning of his own in the translations. In addition to the Vedic wisdom bestowed on him by his guru Swami Virjanand, Swami Dayanand followed Rishi Yask's Nirukt, Rishi Paanini's Ashtadhyayi with the science of word formation and Nighantu, an ancient word assemblage of Vedic terms. Instead of admiring Swami Dayanand Sarasvati's incredible scholarship, Max Muller wrote disparagingly of Swami Dayanand's translation: "*… I have not found some demonstration of new thinking."*

Tired of Max Muller's arrogance emanating from his incompetence as a translator and interpreter of RigVeda, his contemporary Pundit Guru Datta Vidyarthi questioned him by analyzing his mantra translations. Based on Sanskrit grammar and etymology of Vedic terms, Guru Datta took up Muller's mantra translations and pointed out how *'incongruous,*

*unintelligible and superficial'* his translations were. Some passages from "The Terminology of the Vedas and European Scholars", authored by Guru Datta are reproduced in what follows.

Guru Datta points out that in one mantra alone (RigVeda, 1/162/2) Max Muller wrongly translated nine words out of about only a dozen words that formed the mantra couplet. Following is Pundit Guru Datta's text (reproduced from "Works of Pt. Guru Datta Vidyarthi", edited by Dr. Ram Prakash, Professor of Chemistry (Punjab University) published in 1998.

Guru Datta Vidyarthi states:

"We come now to the second mantra which runs thus:

यन्निर्णिजा रेक्णसा प्रावृतस्य रातिं गृभीतां मुखतो नयंति ।
सुप्राङजो मेम्यद्विश्वरुप इन्द्रापूष्णो: प्रियमप्येति पाथ: ॥(RigVeda, 1/162/2)

**Transliteration:**

"*Yannirnija reknsa praavritasya raatim gribheetaam mukhto nayanti |*
*Supraangjo memyadvishvaroop indraapooshno priyamapyeti paathh* ॥"

**Max Muller's translation** of this mantra is –

> "*When they lead before the horse, which is decked with pure gold ornaments, the offering, firmly grasped, the spotted goat bleats while walking onwards; it goes the path beloved by Indra and Pushan*."

"Here again there is no sense in the passage. The bleating of the goat has no connection with the leading of the offering before the horse, nor any with its walking onwards. Nor is the path of Indra and Pushan in any way defined. In fact it is very clear that there is no definite specific relation between the first mantra and this, according to Muller's translation, unless a far-fetched connection be forced by the imagination bent to discover or invent some curious inconceivable mythology. And now to the application of the principle that all Vedic terms are *yaugik*. Max Muller translates *reknasas* into gold ornaments, whereas it only means wealth (see Nighantu, ii.10). *Rati* which signifies the mere act of giving is converted into an 'offering';

*vishvarupa* which only means one 'having an idea of all forms' is converted into 'spotted'; *aja* which means 'a man once born in wisdom, *being never born again*', is converted into a 'goat'; *memyai*, from root *mi* to injure is given to 'bleating'; *suprang*, which means from root *prachh* to question, 'one who is able enough to put questions elegantly', is translated as 'walking onwards', *pathah* which only means drink or food, is translated into 'path' and lastly, indra and pushan, instead of meaning the governing people and strong are again made to signify two deities with their proper names 'Indra' and 'Pushan'. Concerning the word *pathah*, writes Yask, vi.7. .. (a sutra cited from Yask).. *Mukhato nayanti*, which means, "they bring out of the organ of speech, or they explain or preach', is translated by Max Muller into 'they lead before".

"It is thus clear that, in this one mantra alone, there are nine words that have been wrongly translated by Max Muller, and all is due to this that the *yaugik* sense of the words has been ignored, the *rudhi* or the *laukika* sense being every where forced in the translation."

Based on the above word analysis Pundit Guru Datta presented the composite translation of the mantra as:

> "*They who preach that only wealth earned by righteous means should be appropriated and spent, and those born in wisdom, who are well versed in questioning others elegantly, in the science of forms, and in correcting the unwise, these and such alone drink the potion of strength and of power to govern*."

Pundit Guru Datta Vidyarthi emphasized that when a Veda mantra is translated with the *yaugik* meaning of the Vedic terms with proper grammar rules, it yields a purposeful and sensible meaning. Additionally, it also reveals insight into the profound and extraordinary thinking of the *rishi* of the mantra. From Guru Datta's writings one gets considerable insight into the literary activity pertaining to the Vedas during the 18th and 19th centuries. The works of a few more prominent Western Sanskritists of that era are cited in the following.

H. H. Wilson (1850-1888) wrote a book entitled 'Religious and Philosophical Systems of India'. Based on Acharya Sayana's commentary on RigVeda Wilson also translated RigVeda into English. As pointed out earlier, Swami Dayanand Sarasvati in his RigVeda translation into the Hindi language pointed out the deficiencies in Wilson's RigVeda translation. Arthur Anthony Macdonell (1854-1930) was a student of Professor Max

Muller. Even though there was a large pool of highly qualified competent senior Sanskrit scholars of Indian origin teaching in Kolkata University, Macdonell was appointed as the head of the Sanskrit Department under the British Education Plan. He wrote several books: 'History of Vedic Grammar', 'History of Vedic Mythology', 'A Sanskrit Grammar for Students', 'A History Of Sanskrit Literature', 'A Summary of the Deities and Myths of the Rgveda' etcetra. Obviously, like his guru Max Muller, he was a prolific writer. Based on the discussion in this chapter, one can imagine the literary pollution they together generated!

As an example, only one incident related to Macdonell's level of understanding of the Vedas is cited here. Vedic scholars of India pointed out that in his writings he grossly erred on finding polytheism (multiple gods) in the Vedas and that he and his teacher Max Muller were completely off base because the Vedas had only a unitary, formless universal spirit, the God-entity. Macdonell vehemently disagreed. Out of the many mantras stating that the Vedas only had one God, a particular mantra from the first chapter of RigVeda (1/164/46) was brought to his notice. The second part of the mantra states:-

एकं सद्विप्रा बहुधा वद्न्त्यग्निं यमं मातरिश्वानमाहुः। RigVeda (1/164/46)

"*Ekam sadvipra bahudha vadantyagnim yamam maatrishvaanmaahu*."

This means,

"*God is only one and owing to his virtues the intellectuals address Him with different names such as agni* (all-pervading energy), *yam* (all-controlling), *vaayu* (all-pervading dynamic force)".

Although the first line of this mantra is not presented here, it also mentions several other names attributed to the same unitary all-pervading spirit, referring to the virtues of the Creator.

To salvage his reputation as an authority on the Vedas and to continue to hog the undeserved lucrative position of Sanskrit Chair at the Kolkata University, Macdonell came up with an argument. He said that this mantra was not an original Veda mantra and was inserted later in the RigVeda. To save his credibility he did not hesitate to concoct this absurd hypothesis, not realizing that he was negating another of his own equally absurd previous hypothesis. He had earlier put forward a baseless hypothesis that 8 out of 10 *mandalas* (chapters) of RigVeda were written first and the last two were

added later! In his weak defense, he forgot the basic logic that the structure of the Vedas is such that even if someone were to insert a mantra, it could be inserted only at the end of the last chapter or at the most in the last two *mandalas*, which according to his arbitrary theory were added later. However, the particular RigVeda mantra on monotheism, pointed out to Macdonell and Max Muller by the scholarly Sanskrit pundits is in RigVeda's very first *mandala* (chapter) and not in the last *mandalas*. As cited above by this author, it is the 46$^{th}$ mantra out of 51 mantras in the 164$^{th}$ *sukta* of the first *mandala*.

Even if Macdonell thought that the mantra in question was inserted later in the first *mandala* of RigVeda, the fact remains that through this mantra the RigVeda emphasized monotheism. Conveniently, he also forgot what his guru Max Muller had stated in the third chapter of 'India - What Can It Teach Us?' that the collection of the Vedic Hymns in the order in which they are found presently, existed from at least 1500 BC. Max Muller in the seventh chapter of the same book again emphasized that all the 10,580 RigVeda mantras, all in perfect meter, were composed about 1500 BC and handed down without any variation up until 1500 AD.

Macdonell, his guru Max Muller and all those under Max Muller et al. were in a quandary because accepting that the Vedas had monotheism would mean that all their translations and interpretations of the Vedas were a huge infringement and that would be disastrous for their academic reputations. Accepting their mistake would have equated their lifetime's literary work to zero. Between Macdonell and Max Muller it was a case of '*yatha guru tatha shishya'*, meaning 'as is the guru so is the student'. As far as the Vedic culture and religion is concerned, the literature that this duo produced is as good as offal. The ego and superiority complex of these personalities would not let them accept their mistakes and grow in wisdom. They rejected the most understood principle in the Vedas and Vedic philosophy, that to achieve enlightenment and up-liftment of the consciousness (soul), one must let go of one's ego. No wonder that Max Muller et al. did not grasp the prime Vedic principle of monotheism, the principle of the unitary God-entity.

Yet another Western Sanskritist, Sir M. Monier-Williams who wrote 'Indian Wisdom', 'Sanskrit English Dictionary (1899)' and 'The Study of Sanskrit in Relation to Missionary Work in India (1961) said:

'*When the walls of mighty fortress of Hinduism are encircled, undermined and finally stormed by the soldiers, of the cross, the victory of Christianity must be signal and complete'*.(taken from Vidyananda Sarasvati, "Ved Meemansa", 1984, p15).

Pundit Guru Datta Vidyarthi in a lecture entitled, "The Hymns of the Vedas" took up 13 points from Monier Williams' criticism of the Vedas and presenting mantras after mantras from Rik, Yaju and Atharva Vedas, he showed that the Vedas only had monotheism. He presented the summary of a set of five mantras from AtharvaVeda (13/4/16-18, 20, 21) showing that monotheism was the only theism in the Vedas:

"*He is only one, there is no second, no third, no fourth God. There is no fifth, no sixth, no seventh God. Yes, there is no eighth, no ninth, no tenth God. In Him, the Unitary Being, all live, move and have their being*". AtharvaVeda (13/4/16-18)

In spite of the scholarly Vedic pundits pointing out the deficiencies in their translations of the Vedas, the Sanskritists such as Sir M. Monier-Williams continued writing and publishing. Unfortunately, what they wrote continues to serve as a resource for researchers in Sanskrit Literature. Included among Max Muller et al. is also Arthur Berriedale Keith (1879-1944) (author of 'History of Sanskrit Literature') who assigned the age of the Vedas to be 1400 BCE whereas H. H. Wilson and R.T.H. Griffith assigned it 2000 BCE. It is conceivable that a number of Ph.D. dissertations were written based on Max Muller et al.'s misinterpretation of the Vedas. The process unfortunately continues.

# CHAPTER 5: The Primary Vedic Entities in the Creation of the Universe

## Vedic Terms in Cosmology

Developments in contemporary cosmology have led to the development of new physics terminology. One does not expect this to happen in the most ancient Vedic philosophy, science and cosmology in particular. The self-sufficiency and value of the Vedic terminology can only be assessed from what already exists. The limited number of examples of the terms in Vedic cosmology presented in the previous chapters would indicate that the Vedic definitions of cosmology terms are unique and deep in meaning. The word-formation in Sanskrit being root-based, each term conveys the meaning that it is derived for. It also puts a restriction on an inappropriate usage of a term. Therefore, if a term is used in cosmology, it has to convey a meaning that relates to cosmology. Emphasizing, analyzing and interpreting a specific term in Vedic cosmology helps a reader to go deeper into the meaning of the term.

A precondition for Vedic creation is to recognize the pre-existence of certain real entities of eternal nature that take part in the creation process as 'general cause', 'material cause' and 'efficient cause'. Some of these entities remain unchanged and unconsumed in the process while the others change in their physical form and shape. For example the inert Nature, the matter conglomerate of fundamental particles, the 'material cause', pre-exists at the commencement of the creation and enters into a transient phase during the creation. The formation of the universe consumes it totally, exhibiting it in the form of observable and non-observable cosmos and energy, yet conserved in its totality during and after the creation. No substance in the universe is formed in isolation. It requires a minimum essential set of entities at causal level for it to come into existence. This is true for the universe itself.

The eternal cyclic order of creation and dissolution in the Vedic cosmology requires an eternal set of entities which serve as the stepping-

stone for a creation and serve as the cause for the next steps to follow. The laws of nature must pre-exist to create the first physical systems in the universe and these first systems also under the laws of nature must serve as the cause in the next steps of creation. This chain in creation helps sustain the universe and prevents the universe from entering into chaos.

To express the process of creation of the universe one needs a smart set of terminology and the set of entities that partake in the creation. The necessary condition however is that all partaking entities are defined with clarity and there is no violation of the universal principle 'cause-and-effect'.

In the Vedic perspective, all things that we see around us and all that we are unable to see but observe the effects that they create, the substantive diversity of matter or energy forms, together make up the universe. The observed inherent transience in the nature of substances, with previous substances serving as the 'cause' for the new substances, leads us to think that all substances of the universe have come into existence at some point in time and collectively the entire universe also had come into existent at some point in time. As mentioned above, in the Vedic creation, inert Nature and certain real entities are eternal and do not come into existence at a given point in time.

The two components of the 'creation' in the Vedic framework, animate and inanimate respectively relate to the creation pertaining to the consciousness (spiritual) and the inert physical aspect of the universe. Both components come into action at a given moment in time. This may sound similar to what is in other religious traditions; however, the Vedic perspective on this differs significantly at the fine structure. The differences pertain respectively to two different realms of governing laws, *ritam* and *satyam*. According to the Vedas the *ritam* laws govern the consciousness realm of creation and the *satyam* governing the inert physical creation. The consciousness having strong relationship with the inert matter, the *satyam* laws are encompassed by the *ritam* laws.

Frequently used Vedic Cosmology terms are as follows:

सृष्टि (***Srishti***)**,** सर्ग (***Sarg***)**,** जगत (***Jagat***)**,**

## प्रलय (***Pralaya***)

The English term 'creation' is for the phenomenon of forming the universe. The equivalent term in Sanskrit is सृष्टि (*Srishti*). When the root of the term सृष्टि (*Srishti*) is analyzed from the perspective of the Vedas and the Sanskrit language one learns that the term has strong relationship to a physics process than to a religious connotation. The etymology of the term सृष्टि (*srishti*) reveals that the universe has come into existence at a given point in time and it encompasses the advent of both realms of the universe - animate and inanimate. The other expressions such as 'creation of the universe' and 'Vedic Creation Principle' are all included in the Vedic term "*srishti*".

The root meaning of the word सृष्टि (*srishti*) tells us that it is सृष्टि (*srishti*) because it has undergone सृजन (*srijan*), the process of formation. Therefore the सृष्टि (*srishti*) is - *'the one which has been created'*. Implicit here is that it is not something that has its existence without a beginning, as hypothesized in some of the modern cosmology theories, discussed in Chapter 2. The Vedic term *srishti* represents the universe as an entity that began to come into existence at a given point in time. The connotation of the word *srishti* includes – "*one with a beginning and existence*" and "*not an ever-existing phenomenon"*, latter being contrary to the 'Steady State Hypothesis' in contemporary cosmology.

The term सर्ग (*sarg*) encompasses the active phase of the universe during its existence and stands for the visible and invisible matter, in the form of cosmos, forces and energies that carry on their dynamic activity within the *ritam* and *satyam* laws. While the word *srishti* represents a cosmological event (the past) and its existence (the present), the word *sarg* represents –'*the present functioning universe*'.

The word जगत (*jagat*) for the universe is a fascinating term that tells us exactly how most contemporary cosmologist see it; that the universe has come into being, that it will disappear and that it is functioning presently between its beginning and end; yes, all three properties are concealed in the three syllable term जगत (*jagat*). At the same time the word *jagat* exhibits the marvel of the Sanskrit language where there is no dearth of proper nomenclature in all areas of this creation; natural and super-natural. This

simple three syllable Vedic term *jagat,* though common in usage in all Sanskrit-based Indian languages, including the slang expressions of the Indian countryside, has amazing depth in it and therefore requires further analysis.

The Vedic Sanskrit grammar and philology reveals that the term जगत *(jagat)* originates from three separate roots. These three roots forming the conjoined word जगत are three single letters/syllables: ज **+** ग **+** त **=** *ja + ga + ta*. The three verbs for the three roots are:

ज **=** *ja* → जायते ( *jayate iti jagat*) stands for '*one that is born* or *one that comes into existence*'; both apply.

ग **=** *ga* → गच्छति (*gachchhati*) stands for '*one that goes away* or *one that ends its presence*'

त = *ta* → तिष्ठति (*tishthati*) stands for '*one that stays* or *one that exists or one that persists*'

The Vedic creation therefore stands for a phenomenon that happens in reality wherein '*it is created*', '*it ceases to be*' and '*it exists*' between its two ends. The formation of the single word ज + ग + त = *ja + ga + ta* = जगत *(jagat)* from the first letters of the three different verbs is remarkable. The Veda mantras (RigVeda 10/129, 190) in the *suktas* on the creation of the universe, discussed in Chapter 6, further reveal that the *srishti* is not a one-time event; rather it is a cyclic event with a Veda assigned definite time period.

The common nouns for the three stages of creation are thus related to these roots as: in the term *jagat =ja-ga-ta,* the *ja* relates to *srishti*, *ta* relates to *sarg* and *ga* relates to प्रलय (*pralaya)*. The word *pra-laya* in the above heading represents the 'dissolution' of the universe where the nature dissolves into its causal state, a non-recognizable state of matter where matter enters into an indefinable state, yet continues to exist in non-active form till the onset of the next creation. The word *laya* alone in the word *pralaya* is sufficient to define the 'dissolution' of the universe; however, the prefix *pra* to the term *laya* adds emphasis to the process of *laya*, indicating that it is the process that takes place with certainty. The terms *srishti* and *pralaya* are also used to represent the time durations of creation and

dissolution phases respectively. When the term *srishti* is used in the context of the time period it represents the time for creation's activity and also termed as the *Brahmn-din* (God's day). Likewise the term *pralaya* being the time-period for creation's rest, it is termed as *Brahmn-ratri* (God's night). Two other terms expressing the opposite nature of *srishti* and *pralaya* are *kalp* and *vikalp*; defined below.

## *Kalp* and *Vikalp*

*Kalp* is the creation phase of the universe lasting for a period of 1,000 *deva-yugas* of 4.32 BY (Billion Years, AtharvaVeda, 8/2/21) each, when the matter is in *Sata*-state, a state that is utilizable to form substances, objects, forces and energy forms of the universe. The s*rishti, sarg* and *jagat* adjectives of the universe exist in the *kalp* phase. *Vikalp* is the period of the dissolution phase of the universe, also lasting 4.32 BY, the same length of period as in the *kalp* phase. The *pralaya* phase belongs to the *vikalp* period when the matter of the universe enters back into its indefinable *Asata*-state. This state of Nature is also termed as *avyakta* (*a-vyakta*) meaning- '*not explicable in words*'. Just as the period of a day is one day of humans, the Vedas have termed the period of a *kalp* as God's one day and just as the period of a night is one night of humans, the Vedas have termed the period of a *vikalp* as God's one night. Compared to this perennial cycle of *kalp* and *vikalp* in the Vedic principle, the modern Big Bang Hypothesis creates the universe only once; not knowing what happened before the Big Bang.

The Vedic creation process discussed in detail in Chapters 7 to 10 is complex and beyond the simplicity of the expression - "*Let there be light and the light was there*". The Nature in the Vedic creation process switches into the *Sata*-state at a given point in time, enters into the creation phase, prepares the primordial matter developing necessary heat energy over a period of one *deva-yuga* of 4.32 MY before creating a tremendous explosion in it hurling matter far and wide. Then a sequence of entities of matter (energies, forces, fields, physical and metaphysical systems, visible matter etc), referred to in numerous mantras to be cited later, are created which further branch off to create other visible and invisible, macro and minute forms of entities. These are created because they are deemed essential to sustain the existence of the universe and all things in it including life on Earth and throughout the universe.

The Nature has strewn splendor around us in its utmost complexity in the form of mountains, rivers, oceans and the part of the living universe itself. All this is the variety of matter with emblems that form features of a *kalp* that disappear in *vikalp* including a large number of invisible forces, systems and phenomena of the creation phase. This is equivalent of saying that in a *vikalp,* the matter of the universe ceases to carry forward any memory of a *kalp*. Are there entities if any in Vedic creation that continue their existence in both phases so that something more could be extracted before t = 0 sec of a Big Bang? It is not known from the contemporary Big Bang Hypothesis whether more information could be extracted from such entities if subjected to a mathematical treatment that could take us back in time, however, the Vedic terms for the entities that continue through both the phases of kalp and *vikalp* in Nature are said to be *anaadi* and *nitya*.

## *Anaadi* and *Nitya* (अनादि, नित्य)

The word *anaadi* means '*one that does not have a beginning*'. The equivalent term for *anaadi* is eternal. In a perennial cycle of creation such as in the Vedas, the Time and Space entities preexisted and will continue to exist during the *pralaya* phase of Nature. Therefore, they are the *anaadi* entities of Vedic cosmology. When one leaves the physical realm defining *anaadi* entity to be '*without a beginning and end*' and enters into the realm of Vedic philosophy one invokes the framework of cause-effect. Then the *anaadi* is defined as:

'*An anaadi entity is not an effect of a cause but serves as a cause for other effects*'.

In modern physics, one can have a premise to create matter out of nothing and can even infer a proof for it. One can even have a fantasy of phantom particles that appear and disappear to create matter at a given point in space 'out of nothing'. Even then it is not said that the existence of a substantive matter particle consumed a piece of Time or a piece of Space. However, nothing in the universe is created without the pre-existence of time and space – in 'time' it is created and in 'space' it is placed.

A natural question here is - why the Vedas would assign *anaadi* (eternal) status to certain entities like Time and Space that have no cause for

their own birth and existence. The logic in the Vedic perspective is that because the Vedic creation-dissolution process is cyclic and eternal the *anaadi* Time and Space entities have to be always available to serve as the *saadharan-kaaran* (ordinary-cause). The causes that might create Time and Space are not observed in the universe, but the existence of Time and Space is either observed or inferred from the observed effect that they are responsible for. Modern cosmologists accept the reality of Time and Space but cannot create in the laboratory a piece of either, no one can. The Vedas recognized that if Time and Space were consumed during the creation process, they would be exhausted and nothing would be left for the present and the future creations. The Veda mantra formulations have recognized Time and Space for what they are and assigned the category of अनादि (*anaadi* = eternal) to them.

Another important term in Vedic philosophy that relates the entities and substances to their existence is **नित्य** (*nitya*). The term *nitya* will become clear from a few *sutras* from the fourth chapter of Rishi Kanaad's Vaisheshik Darshan.

सदकारणवन्नित्यम् ।

(sadkaaranavan-nityam, Vaisheshik, 4/1/1)

**Sutra Translation**

"*A substance in existence that has no cause for its existence is nitya.*" (Vaisheshik, 4/1/1), and,

तस्य कार्यं लिङ्गम ।

(tasya kaaryam lingam, Vaisheshik, 4/1/2).

**Sutra Translation**

*"The action (cause) is its defining characteristic (lingam)".* (Vaisheshik, 4/1/2).

because,

कारणभावात् कार्यभाव: ।

(kaaranbhaavaat kaaryabhaavah, Vaisheshik, 4/1/3).

**Sutra Translation**

*"The existence of cause leads to the existence of effect"* (Vaisheshik, 4/1/3)

Rishi Kanaad is conveying here that those substances or entities that have no cause for their being but can be the cause for the other substances are *nitya* (eternal and ever-present) and that such entities must exist before they cause an effect. On the other hand a substance resulting from a cause (action) and is only an intermediate cause of a subsequent effect, is transient in nature and thus termed as *a-nitya* (non-*nitya*).

In a definition akin to physics, the *nitya* substances are invariants in Time and Space, inclusive of Time and Space themselves. The terms *anaadi* and *nitya* (eternal and non-transient) are synonymously used in Vedic philosophy. With respect to entities forming the universe, the difference and similarity between the Vedic and modern Big Bang concepts is quite obvious. Whereas the Time and Space are *anadi* and *nitya* in the Vedas, they are treated in Big Bang Hypothesis as *nitya* (ever-present) after the Big Bang Hypothesis's t = 0 sec. This is a contradiction in Big Bang Hypothesis because one cannot create an entity and make it an 'ever-present' entity for the rest of its life without a mechanism for its growth. Unless the Big Bang Hypothesis comes up with the cause of Time and Space, the hypothesis itself cannot be considered based on a sound illogic.

On one hand the effulgent variety of Nature is praised in the Vedic mantras and Upanishad formulations and on the other hand it is also declared to be an *anitya* phenomenon, transient on a short term basis and ending completely into an indefinable state at the time of *pralaya* dissolution, when even the laws of Nature under *satyam* disappear. That indefinable state of all matter of the universe will still remain an entity called *Prakriti* in the Vedas, which is the inert Nature in a suspended state for a period, waiting to spring into a new creation phase.

Four important entities of modern cosmology are: Space, Time, matter (including Dark Matter) and Dark Energy, discussed in Chapter 2. Since modern cosmology is unable to claim with certainty the mechanisms for the birth or death of these entities, one cannot assign them the label of eternal

or non-eternal. The Dark Energy being energy, a degenerate form of matter, which by definition is an effect, would not pass as an eternal entity in the Vedic frame of reference. There are five eternal entities in the Vedic cosmology that participate in the cause-effect process. Surprisingly, three of them are the same as in modern cosmology. Since the Vedic creation follows an eternal cycle, these five entities are considered to be eternal. They are defined in the sections to follow after the terms *ritam* and *satyam* are defined.

## ऋतम् (Ritam) and सत्यम् (Satyam)

There are several constants and invariant laws of Nature that enabled Nature to form the universe and continue to provide continuity to the universe. An example from this set is the gravitational constant G and the law of gravitation discussed in Chapter 2. Any change in these constants and laws would create chaos. The Vedic theistic approach for the advent of the universe stipulates that the creation takes place under the specific laws that the conscious-being Creator imposes on the preexisting Nature. All laws governing the animate and inanimate creation come under the *ritam* and *satyam* laws.

If the Creator is taken out of the picture the Nature has to create its own laws. There is no indication in Nature for a trial and error methodology for evolving its laws. The matter of the universe is created under Nature's laws but under what laws the Nature (matter) created the laws that create matter? The universe in a theistic reference frame is created by the will of a conscious-being Creator. For example, when a human-being generates a thought in his mind to write a sentence on a piece of paper the non-substantive thought alone is not capable of writing the sentence down. To implement the writing of the non-substantive thought that the mind created, the mind also creates a thought that instructs the substantive hand of the living-being to carry out the instruction. The logic in the Vedic premise is that the formless all-pervading Creator has the will-power and thought to create the universe, but it needs hands to carry out the job. The *ritam* and *satyam* laws are formless Creator's formless, invisible, non-substantive perfect hands. The 'mind over matter' is the underlying premise.

The modern cosmology assumes that there is only the physical realm of the universe that comes into existence under the physical laws. The Vedic

Cosmology on the other hand emphasizes that there are two realms of the creation where two sets of laws apply, the spiritual (consciousness) realm and the physical realm. All laws pertaining to the consciousness creation go under ऋतम् (*ritam*) and all the laws pertaining to the physical creation go under सत्यम् (*satyam*). To express it differently, the ऋतम् (*ritam*) laws and the सत्यम् (*satyam*) laws respectively govern the animate and the inanimate creation. The ऋतम् (*ritam*) and सत्यम् (*satyam*), pronounced with soft 't' are some of the most fundamental terms of the Vedic cosmology and philosophy.

To elucidate the point further let us take the example of Newton's third law which states - "*To every action there is an equal and opposite reaction"*. This law applies to an 'action' in the physics realm. The Sanskrit term for 'action' is 'karma'. In the context of the gravitation of the Earth, Rishi Kanaad stated in his Vaisheshik Darshan (5/2/1, 5/2/2) that the property of gravity in the Earth is its अदृष्टकारितम् (*adrisht-**kaaritam***), where the term *adrisht* means 'invisible' and ***kaaritam*** means 'karma' (action). The karma in this case is generated by an inert entity, the Earth. The 'action' under the cause-effect rule is the cause and the 'reaction' is the effect (result). Dealing with everything physical (material) this rule comes under Creator's सत्यम् (*satyam*) system.

When one moves from the physical realm to the consciousness realm the 'karma' is generated by a living-being. A living-being can do karma that is pure physical in nature and inconsequential. Also a living-being owing to the free-will can do karma that affects favourably or adversely the other conscious-beings. Such a karma is respectively labeled as 'good karma' or 'bad karma'. But because it is also 'karma' (action) it should generate a right 'reaction' (result). There is no law in physics to cover such an "action-result" equation because physics does not deal with the animate creation (consciousness). According to the Vedas all laws governing the consciousness realm (animate-creation) including the balance in "karma-result" of an individual conscious-being, come under the Creator's ऋतम् (*ritam*) system. The physics laws that have been discovered by physicists and those remaining to be discovered, do account for the physical universe under *satyam* but the metaphysical part of the universe remains hidden and unaccounted for. If this is not taken care of the system is not fair. As this

author has grasped it from the Vedic philosophy, the ऋतम् (*ritam*) system encompasses all implicit rules of the creation, physical and metaphysical, that never change and the सत्यम् (*satyam*) system of rules encompasses all explicit rules governing the created physical universe that also do not change during the creation phase of the universe. Just as the 'truth' is truth which never changes with time, never transits into something else, the *ritam* and *satyam*, encompassing unchanging rules of creation and dissolution are together addressed as Creator's unchanging *ritam* and *satyam* systems.

With regard to the invariance of the ऋतम् (*ritam*) system the unchanging karma principle binds the conscious-being soul such that the doer of the karma bares the effect (consequence), good for good and bad for bad. The karma principle operates at spiritual level to which physics laws do not apply and the soul has no choice but to function within this foreordained unchanging system. As in Newton's third law on action-reaction applicable to the physical realm, there is equivalence between the karma and its consequence in the metaphysical realm.

The *ritam* and *satyam* relate to each other yet have their application at two distinct levels. The comprehension of the term *ritam* is at a qualitative and philosophical level to relate to queries such as - why is the creation of the universe initiated, why it is in a given form, who is behind this creation, why is there consciousness in the creation and the other questions of this nature. The comprehension of the term *satyam* on the other hand is at an obvious level because it applies to the matter that has come into existence in the form of observed Nature. Since the matter (Nature) of the universe comes into existence under *satyam* its sustenance and the process of dissolution also come under *satyam*. For a modern physicist all transience in Nature in the form of physical phenomena from the beginning of the creation to the present, pertain to Nature alone and are seen directed by Nature itself. The physicist however does not answer the basic question – if the Nature created all physical laws with perfection at the first attempt during the early moments of the Big Bang, without any sign of evolving and finalizing any of the physics laws, why does the process of creating laws not continue for the rest of the universe's life? Many such questions remain outstanding.

Some modern physicists have suggested that the universal constants of Nature, such as the gravitational constant G, may not be constant and

instead changing with time. Under the Vedic principle of *satyam*, the physical laws of Nature remain invariant through the creation. Also, because the Vedic creation is a continuum cycle of *srishti* and *pralaya* (creation and dissolution) there have to be rules that govern the Nature even during the dissolution phase. It is the *ritam* of the Creator that continues even through the dissolution phase of Nature when the physical laws under *satyam* governing it, disappear along with the universe.

The first mantra of the 190th *sukta* of the 10th *mandala* (chapter) of RigVeda simultaneously states the terms ऋतम् (*ritam*) and सत्यम् (*satyam*) in relation to the Vedic principle of creation. A detailed discussion on the mantra is in Chapter 6; here the meaning of the first part of the mantra is presented in the context of *ritam* and *satyam*. It states:

ऋतं च सत्यं चाभीध्दात्तपसोऽध्यजायत । (RigVeda, 10/190/1)

**Transliteration:**

"Ritam cha satyam chabhiddhattapaso addhyajaayata ।"

**Mantra Translation:**

*"Under All-illume Creator's ritam and satyam rules and His tapasaha, the heat form of energy, the Nature comes into its day-epoch of creation…."*
(RigVeda, 10/190/1).

## The *Eekshana* Force

*Eekshana* is a force created in the mind of a conscious-being by the consciousness. When the conscious mind creates a thought it also creates a quantum of instruction in the brain to implement that thought. For implementation of the instruction the brain uses the *eekshana* force to orders a limb in the physical body of the conscious-being to generate the desired mechanical action. The term *eekshana* of Vedic philosophy can be translated into common English as 'desire' or 'free-will'. However, the terms 'desire' and 'free-will' alone do not represent the essence of the *eekshana* force, a force that is of metaphysical nature, enabling the creation of tangible objects. All subtle forces operational through the living physical body of a conscious-being according to the Vedic creation are physical or

metaphysical but the entity exerting *eekshana* that generates the force to create action is neither physical nor metaphysical, it is spiritual. It is the *atma*-entity the soul. It is also written and expressed as *atman*. A section is devoted in the following to this entity that serves as the general-cause in the creation of the universe. It is the inner force of a conscious-being that through *eekshana* translates a creative idea into observable tangible physical object. Four forces of physical nature were discussed in Chapter 2, namely, 'Strong Force', 'Weak Force', 'Electro-Magnetic Force' and 'Gravitational Force'. These forces exist in Nature but the *eekshana* force, different from these physical forces, is created by the consciousness in the living physical body of a conscious-being. The conscious-being utilizes it to create mechanical action. A short discussion on *eekshana* is presented below.

While answering questions on the creation of the universe, the Vedic philosopher Swami Dayanand Sarasvati commented on *eekshana* in the eighth chapter of Satyarth Prakash (1881 CE) written in Hindi language. His specific definition of *eekshana*, translated by this author into English is:

> *"Eekshana is the power of the mind with the combination of three factors; visualization, thought and desire, by which a conscious-being is able to create tangible things".*

This trait in conscious-beings is absent in inert objects. Since the Creator is considered to be an all-pervading force, with consciousness as His additional attribute, Creator's *eekshana* power is also all-pervading. Because the *eekshana* creates impetus to create tangible things, Swami Dayanand Sarasvati ascribed the *eekshana* virtue in the unitary universal spirit, the Creator, to supply necessary impetus to the inert Nature, the building material of the universe, to launch into action. This action renders the effulgent tangible universe. It is the recondite *eekshana* force that forms the link between the conscious-being Creator and the created inert matter of the universe.

In contrast with the all-pervading *eekshana* of the conscious-being Creator the quantized conscious-beings *atmas* (souls), localized in their individual physical bodies, having been endowed with limited *eekshana*, are limited in their ability and power to exert their influence in a limited sphere of action. Conversely the presence of *eekshana* in a living matter-

conglomerate is the proof of the presence of consciousness in that mass – the living body.

To ascertain the presence of consciousness in a physical body, one should be able to observe the triplet - *visualization, thought* and *desire*; primarily in the physical body that created a tangible object and secondarily the reflection of the triplet in the created tangible object. It is the triplet-virtue of *eekshana* that leads to an intelligent design. No intelligent design on Earth, ranging from the creation of a piece of script by an author to a wonder of the world is possible without the three components of *eekshana*. Only one or two components are not sufficient to create a tangible object with intelligent design. The living-beings create small tangible objects and the all-pervading *eekshana of the Creator* creates the enormous universe. The universe, observed by the Vedic *rishis* as a tangible object was deemed as the result of all-pervading *eekshana* with *visualization, thought* and *desire*. This would differentiate the Vedic philosophy from the other philosophies which also advocate intelligent design. Included in Vedic creation is the intelligent design of the whole universe with unwavering physical laws of Nature playing their role in the physical realm. This also includes the physical evolution of humans and the rest of the living-beings under both, the physical laws of Nature and their spiritual evolution under the laws in the consciousness realm. From the Vedic perspective the existence of all invariant physical laws governing Nature, such as the perfect law of gravity, are part of an intelligent design.

In Vedic thinking it is the *eekshana* in a living-being that causes the evolution of the physical body in which it resides. The dexterity in human hand evolved because the *eekshana* rising in living-being's mind directed the hand to evolve in that way and the living-being as a whole evolved to adapt to its own environment because it analyzed and visualized through five knowledge senses linked to *eekshana* to get tangible results. The *eekshana* in Vedic perspective is not a slave of time for the evolution to take millions or billions of years, as advocated in the Darwinian hypothesis. It is the slave of the conscious-being who does have limitations to get quick results.

When a man builds a house for his family members, he is the efficient-cause for the house and the building material its material-cause. He uses the *eekshana* power with the *visualization, thought* and *desire* to build the house, a tangible object. The relationship between the Creator and all the

souls of the universe is similar to the man building a house for the activity and shelter of his family members. To create things is in the nature of conscious-beings, be it God to create the universe or a human-being to create a house. This nature is a general rule of the creation where not just humans but living beings at all levels implement their *eekshana* to create their homes in a best possible way. Ahead of the arrival of chicks a weaver-bird builds an elaborately woven nest which is a wonder of engineering, planning and execution. The insects with tiny bodies create their dwellings with application of chemistry and physics, some of which are difficult for humans to replicate. The *eekshana* with *visualization, thought* and *desire* is seen in action throughout the living creation. The consciousness and recognition of *eekshana* in it is part of the Vedic cosmology. To label it as a mechanical behaviour or instinct in living-beings is low-grading a universal phenomenon deep seated in the universe and exhibited only in living beings.

In Vedic thinking, the creation of the complex bodies of human-beings and the rest of the living-beings is part of the complexity of the universe itself, the complexity that we observe in all physical phenomena. This complexity in the universe is not recent. In the beginning of the universe the scales of physical phenomena were different but the universe was as complex within seconds of the onset of creation as it is now in the form of galaxies, solar systems, biomass on Earth, living bodies and each cell forming a living-being. It did not evolve over billions of years to get more complex. If that early complexity of the physical universe did not take the evolutionary long period of billions of years, then the hypothesis that life began with the first uncomplicated cell evolved over millions of years on its biological path into complex humans, should be questionable. The preclusion of complexity of the human body from the beginning of the creation is equivalent of saying that the universe in Big Bang began with a single nuclear particle and evolved later into complex galaxies. With the same argument, the complexity of a human physical body with its preexistent spiritual stature could be a part of the design of the physical universe with *eekshana* in living beings doing its own part. In Vedic thinking, the obvious complexity of the universe and of the different phenomena within it is only a minute part of the whole creation because much more unobservable, undetectable and ungraspable complexity still exists beyond cognition.

In Vedic philosophy, it is the inherent *eekshana* and its level (power) that dictates a change in the body of a living-being to adapt to the surroundings. The power of *eekshana* in a living being depends on its individual pre-evolution at the metaphysical level (not the Darwinian evolution). In the Vedic philosophy the inheritance comes not only from the parents (DNA) but also beyond the parents, brought in by the immortal quantum of consciousness in the form of metaphysical traits that make each living-being different. Consideration of the phenomenon of non-substantive consciousness directing the creation of tangible things is currently absent from the discussion on cosmology even though it is also a result of cosmology. This discussion is part of another book.

The Vedic cosmology and philosophy together offer a list of inert and spiritual entities that enable a perspective for unifying the physical and metaphysical creation of the universe. Same as in contemporary cosmology the Vedic philosophy considers the Nature-entity (matter) as the "material-cause" and the Time and the Space entities as the "general-cause" (ordinary-cause). Additionally, the Vedic cosmology gives consideration to the Creator-entity as the "efficient-cause" and the discretized field of consciousness as the "general-cause". It is this general-cause, a collection of discretized entities called '*atmas*', that are the 'atoms' of a discretized field of consciousness, that individually and in association with others (parents) take part in the evolution of their own bodies that they occupy while functioning. The five eternal entities mentioned above are defined below.

# The Five Eternal Entities of Vedic Creation

## (1). The Creator-Entity (*Purush-tatva*)

Owing to many virtues, the Creator is addressed with many names. One of the most common names is *Purush*. The term '*purush*' *means – the one pervading all*. The author calls this all-pervading conterminous consciousness as the consciousness of "First-kind", the "Second-kind" being the quantized consciousness – the *Atma* (Soul). To differentiate *Purush* from *Atma* (soul) the Creator is addressed as *Param-atman* (the highest *Atma*). In Vedic philosophy the *Paramatma* and *Atmas* having the common virtue of consciousness and ubiquity are also addressed together as *Purush*.

Other common expressions for the *Purush*-entity are: Omnipotent, Omniscient, Omnipresent, formless, conterminous unitary entity, the supreme consciousness and so on. In the context of cosmology this author has addressed the Creator as the Creation Energy-field.

### Definition of the term '*purush*'

The primary name of the Creator in the Vedas is OM formed with three syllables o u m. When a detailed interpretation of the term o u m is looked up, one finds that the Creator is addressed as OM because it encompasses all creation. When the Creator and Nature are addressed together as a duo the expression is *Purush-Prakriti*. In the compound word *Purush-tatva* the second term *tatva* means 'entity'. RigVeda's $10^{th}$ *mandal*'s $90^{th}$ *sukta* and YajurVeda's $31^{st}$ chapter are devoted to *Purush-devata* (*purush* subject). Swami Dayanand Sarasvati in his book entitled 'Rigvedaadi Bhaasyabhumika' (Publ. Arsh Sahitya Prachar Trust) has presented the interpretive commentary in Sanskrit and Hindi languages on all 22 mantras of the Purush Chapter of YajurVeda. He has substantiated the etymology of the term *purush* citing Nirukt by Rishi Yask.

While interpreting one hundred different Vedic terms for the Creator-entity Swami Dayanand Sarasvati in his book entitled 'Satyarth Prakash'

explains the root-meaning for the term *purush* to be पृ पालनपूरणयो: (*pri paalanpoornayoh*) *to protect and to fill* (complete) and defines the term as य: स्वव्याप्त्या चराऽचर जगत् पृणाति पूरयति वा स पुरुष: (*yah svavyaaptya charaachar jagat prinaati pooryati vaa sa purushah*). This translates into: '*one who is the indweller of all substances of the universe, animate and inanimate*'. The meaning of the term also includes '*one who pervades the entire universe and its substances big and subtle*'.

The Creator-entity's virtues are defined in large number of Veda mantras, *shlokas* of Smritis, statements in Upanishads and the aphorisms of the Darshans. Any commentary on all that is beyond the scope of this book. A representative mantra from the YajurVeda summarizes the virtues of the *Purush* (*Brahmn*),

स पर्यगाच्छुक्रमकायमव्रणमस्नाविरं शुध्दमपापविध्दम् ।

कविर्मनीषी परिभू: स्वयम्भूर्याथातथ्यतोऽ अर्थान्व्यदधाच्छाश्वतीभ्य: समाभ्य: ।। (YajurVeda 40/8)

**Transliteration:**

"Sa paryagachchhukram-akaayam-vrinmasraviram shuddham-apaapviddham ।

Kavirmanneeshee paribhuh swayambhoo-r-yaathaatathyato-a-arthaan-vyadadhat-chchhaashvateebhya samaabhyah ।।"

**Mantra Translation:**

"*The Brahmn is swift and all-powerful (Omnipotent), without a body (formless), without holes and non-permeable, conterminous, all-pervading, omnipresent, omni-directional, unbound by the vice of the system of nerves and arteries, pure without defects, Omniscient, knowing thoughts of all minds, disapprover of sinners, self-existent, eternal entity, revealer of knowledge, creator of all substances for all in His creation. He and He alone is to be worshipped*." (YajurVeda 40/8).

The compact disposition of a large number of terms in this single YajurVeda mantra defining a single entity certainly delineates a linguistic

marvel. Out of some twenty different virtues of Brahmn cited in this single mantra, there are about half a dozen in the context of the physical world and the rest are in the spiritual context. The Vedas give credit to Brahmn who uses his *eekshana* power to create the universe from the preexisting material-cause.

Saankhya Darshan of Kapil Rishi provides a composite set of the physical entities of the Vedic creation where certain energy fields and forces are created as the byproducts of Nature. As stated in his Darshan the *Purush* is the efficient-cause of creation:

स हि सर्ववित् सर्वकर्त्ता । "S*a hi sarva-vith sarva-karta*" (Saankhya, 3/56)

**Sutra Translation:**

"*He is Omniscient and the Creator of the universe in its entirety"*

(Saankhya, 3/56).

Rishi Kapil deals with the age-old physics question–

"C*an one prove the existence of the Creator*"?

Recall from the discussion under 'Immeasurability of Entity' in the beginning of the Chapter 2 where it was inferred that when a field is all-pervading and infinite and is well-beyond the universe, it remains immeasurable and non-provable. Such is the situation with the Creator-entity. Recall the so-called physics *sutra* by this author, formulated in Chapter 2 that, *"The true knowledge of an entity is possible if the instrument of knowledge is able to interact with the entity"*. Under this deduction the detectability of a physical phenomenon hinges on the fact that the instrument used for its detection is made of matter and it interacts with that phenomenon. Since the instruments made out of matter are unsuitable to interact with the Vedic defined Creator a physical detection of the Creator can never be possible. The Creator being the all-pervading consciousness, an instrument made of consciousness by logic could sense the presence of the all-pervading consciousness. However, as was deducted in the Chapter 2, if an entity is not detectable in the physical realm one cannot conclude that the entity did not exist and therefore the supplementary physics *sutra* was laid down by this author - "*Futility of detection of an entity is not a*

*proof of the absence of the entity*". The detectability of one consciousness with another consciousness is a subject beyond the scope of this book.

Let us consider an example from the physical realm. A photo-detector is the instrument to detect light photons. It is made up of a flat surface of photo-sensitive material. When a light photon falls on its surface there is interaction between the light photon and the surface of the photo-detector. In this interaction each photon (corpuscle of light) releases one electron from the molecule of the photo-detector material. The measurement of this electron in the circuitry of the photo-detector yields the indirect detection of the photon. If one exposes the photo-detector surface to the rain the detector fails to detect the number of rain-drops falling on it because the photo-detector surface interacts with light photons and not with the rain-drops. Obviously the photo-detector is able to prove the presence of light and is unable to prove the presence of rain even when the rain is falling on it. This is the gist of 'Immeasurability of Entity'.

All photons falling on the detector come from outside the detector one by one and detected by the detector proving their existence. However, if the detector is immersed in the light field, with photons already inside it and outside it, the detector would not be able to do its job even for detecting the photons. Therefore, when certain entities are all-pervading and infinitely large in their expanse, the immeasurability of such entities is a reality. The provability of such entities runs into difficulty because the provability depends on measurability. The Vedic Creator-entity being infinite and all-pervading, in and beyond the universe, remains non-provable for the same reasons.

A reasonable question is generally asked - if the Nature is observed as a reality and found deterministic by intellectuals (cosmologists) why the Nature is not assumed as the Creator of the universe? Implication of this question is that the Nature is the material-cause as well as the efficient-cause of the creation. A related question was raised eons ago by Kapil Rishi in his Saankhya Darshan (*Shastra*) *sutra* (1/56) as - '*why Ishvar (God) cannot be assumed to be the material cause of the creation*'? Rishi Kapil's answer to this question is in his next-very *sutra* (1/57) wherein he stated that ईश्वरासिद्धे: (*Ishvarasiddheh*), meaning - '*Such an Ishvar cannot be proven'*. What the *sutra* means is that if the Nature is considered to be the *Ishvar* (Creator), such a Creator remains unproven because a material-cause has no initiating properties to create its own universe. Rishi Kapil has

emphasized this to draw a distinction between *Ishvar* (God), a conscious-being and the Nature an inert entity treated in the Veda as the material-cause of the universe.

Rishi Kapil emphasized this again in the third chapter of his Saankhya Darshan stating in the *sutra* (3/56) that the *Ishvar*, "*is Omniscient and the Creator of the universe"* and then he concluded his argument by formulating the next *sutra* in the same chapter stating,

ईदृशेश्वरसिद्धि: सिद्धा ।

"Iddrisheshvarsiddhihi siddha" (Saankhya, 3/57)

**Sutra Translation**

*"Ishvar thus defined has been proven with certainty in this Shastra (Darshan)"*. (Saankhya, 3/57).

The references from the Vedic philosophy are presented here to show how the Vedic philosophy has addressed the subject of logic and cause-effect. The underlying argument of the Vedic philosophy is that the matter of the universe by itself is no different from a dead-body of a living-being without activity in it and without *eekshana* to initiate creation of tangible objects. The same material-body with the presence of a conscious force of a soul in it was a creator of abstract thought and tangible things in its own limited way. The argument of the Vedic philosophy is that if it were left to the inert matter of the Nature, the material-cause, it would not have created anything. To distinguish between the *Prakriti* and *Purush* (*Ishvar*), Bhagvadgita (3/46, 47) states that "*Purush is beyond Nature and nothing is beyond Purush*".

Just as the physicists are credited for discovering Nature's laws that preexisted under what is *satyam* system in Vedic philosophy, the ancient *rishis* in their own way recognized in the mantras the hidden laws under *ritam* and *satyam* and reformulated them in the form of *sutras* and *shlokas* in the Darshans, Smritis and Upanishads. An example of this in *satyam* realm is the Vedic definition of Nature that at its most fundamental level it is quantized in three types of fundamental particles named *sata, raja* and *tama*. Creator-entity is credited by the Vedas for an initiation in the fundamental *Asata*-state of Nature in its undefined material state to send it to the *Sata*-state in its defined matter state. This is a rule under *ritam* under

which each particle of the tri-property Nature becomes active to manifest as matter from the *Asata*-state to the *Sata*-state. This section is summarized with a *sutra* from Saankhya Darshan where the extent and nature of Creator's interaction with Nature is stated,

तत्सन्निधानादधिष्ठातृत्वं मणिवत् ।

("Tatsannidhaanaat adhishthaatritvam manivat"), Saankhya 1/61)

**Sutra Translation:**

*"Activity in Nature is inspired and governed by His (Creator's) interaction with it, as in a mani"*

(Saankhya, 1/61).

Physicists would vouch that all activities in Nature are governed by its unchanging laws. What Saankhya states here is that all these laws of Nature are not created by the inert Nature itself, rather the prime-cause for all actions in Nature is the Creator. The Creator's all-pervading *Eekshana* yields the creation of the tangible entity, the universe. Instead of saying that 'that is the way Nature is', Rishi Kapil in the above aphorism states that the conscious-being Creator interacts with Nature (matter) in a manner similar to light interacting with a *mani* (crystal) without being consumed in the crystal. Whatever laws of nature that we discover, that are necessary for the universe to come into existence and to remain sustained without chaos, may not be too many to count but they are not straightforward and simple. They are abstract and unobvious for all to grasp. They are too complex for inert Nature without brain to create. To create a tangible object one needs a pre-thought with *visualization, thought* and *desire*. This is absent in inert entities.

The explicit simile of the light and the crystal in the *sutra* for God and Nature respectively, is indicative of the fact that two separate entities are involved: one is the energy (light) and the other is the substantive matter (crystal). The usage of a crystal for a simile not only tells us about an observation in physical optics by Rishi Kapil, it also exhibits a perfect example for others to understand the nature of the relationship between two ungraspable entities, the Creator and the Nature.

Since the Nature is an inert entity, the interaction between the Creator and the Nature is one sided; the Nature remaining passive in this interaction. This is also the reason why Rishi Kapil chose the example of a *mani*. The *rudhi* (common) meaning of *mani* is jewel (a crystal). From the perspective of its physical properties a *mani* by definition is an "*object capable of concentrating and revealing"* more than what is obvious. An example for a *mani* in common usage, since ancient times, is the *sphatik-mani*. The Sanskrit term *sphatik-mani* stands for a quartz-crystal. A *sphatik-mani* accepts light and reemits it without being affected by the light.

The other example of a *mani*, in a non-optical application, is *ayaskaantam-mani* which is a magnet. Owing to the magnetic properties in the *ayaskaantam-mani* it creates the concentration of the magnetic field which is demonstrated by the alignment of ferrous material (iron filings). The iron-filings align themselves along the magnetic lines of force owing to their association with the magnetic field of the *ayaskaantam-mani* where there is no consumption of material. In the *sutra*, the example of a *mani* implies that just as the light inspires a crystal to glow and a magnetic field inspires dynamic behaviour in a piece of iron, the Creator inspires the Nature for all activities without being affected Himself.

The Creator can be viewed as a Creation Energy Field just as the several other un-provable hypothetical entities of modern cosmology, discussed in Chapter 2. The Creator (*Brahmn*) has perfected the laws of Nature because unlike the assumed singular event of Big Bang for the creation of the universe, He has created and dissolved the universe, infinite number of times before!

In this book when God is addressed as the first person, this author with the limitation of English language has addressed God as He. God viewed as a formless entity, conscious-being, all-pervading force, cannot be addressed as He, She or It. The Sanskrit language or the Vedic philosophy having no such limitation, addresses God as God. God having many virtues is addressed with many adjectives including 'father' as well as a 'mother'.

# (2). The Nature-entity (*Prakriti-tatva*)

The general properties of the Nature-entity are: Material-cause of the universe, an inert entity, a conflux of matter and its forms, the Vedic defined

Nature at its fundamental level is quantized in three types of fundamental particles:

***satva*, *raja*** and ***tama*.**

The Nature in the Vedas and in post-Veda ancient Vedic Literature, though an inert conglomerate of matter, is addressed as an entity and has many synonyms and adjectives related to its function and context. Acharya Udayaveer Shastri in 'Saankhya Siddhant' (1991) has provided a lengthy discussion on the subject of *Purush* and *Prakriti* with valuable references from ancient writings. This author has benefited from his in-depth philosophical exposure of the complex Vedic concepts and recommends the Hindi readers to explore his writings on all six Darshans.

The *Prakriti* has been expressed variously in the Vedas and Darshans, all leading to the same meaning, that the *Prakriti* is the material-cause of the universe. In Saankhya philosophy (see Saankhya Siddhant by Acharya Udayaveer Shastri, 1991) the term '*prakriti*' for Nature is defined based on its *dhatu* and *pratyaya* (root and affix) as:

> प्रकर्षेण क्रियते सर्वं जगदनया इति प्रकृति:
> (*prakarshen kriyate sarvam jagadnaya iti prakritih*),
> which translates into:-
>
> "*With which the entire universe is pre-eminently created is termed as Prakriti*".

The analysis of the word *prakriti* thus makes it obvious that the universe is a phenomenon created out of *Prakriti* and has a beginning. Because *Prakriti* displays large number of properties and functions it has large number of Sanskrit synonyms. Nomenclatures for *Purush* (Creator) and *Prakriti* (Nature) are differentiated by the *vibhakti* rules of grammar. In a grammatical construct for example the term *prakriti* appears in *tritiya vibhakti*, indicating with certainty that *Nature is tertiary to the Creator* and the Nature and the Creator are *two separate entities*.

The Vedic cosmology terms for Nature by themselves tend to illustrate the Vedic creation story. Whereas the term *Prakriti* indicates the necessity of raw material for the creation and that the process has a beginning, the other important Vedic term for Nature entity being *Pradhan*, indicates that

the story has a definite ending. The term *pradhan* is for प्रकर्षेण धीयते अन्तर्लीयते सर्व जगत् यस्मिंस्तत्

(*prakashen dheeyate antarleeyate sarva jagat yasminstat*) which translates into:

'*Because it pre-eminently exists in creation phase and dissolves the entire universe within itself, that is why (it is Pradhan).*

These two terms for nature in fact establish the primary Vedic principle that the universe has a beginning and an end. Further along in the Veda mantras is the emphasis that the creation and dissolution is a definite perennial cycle that is imposed on Nature under the Creator's *ritam*.

There are two different Vedic terms used for Nature entity in two successive mantras of RigVeda's *Bhavavrittam sukta* on the history of creation of the universe, discussed in detail in Chapter 6. The term *Svadha* (RigVeda, 5/34/1; 10/129/1, 5; 1/164/38; 1/165/5, 6) stands for '*the entity with eternal self-existence*'; implicit in it is its causal status that it is not an effect of a cause. The second term *Salilam* there means '*the entity with fluidity with all its properties dissolved into uniformity*'.

An argument based on the meaning of the term *Svadha* could be raised by a modern cosmologist that if the Nature is '*the entity with eternal self-existence*' then it could, without Creator's help, self-generate into a universe under its governing physical laws and dissolve itself under the same laws into an indefinable state. The disagreement from the Vedic philosophy relates to physical laws of Nature and the nature of Nature.

To create a universe the matter must follow some physical laws. If the laws are created first where do they exist if the matter is not created yet? If the matter and the laws of Nature are created simultaneously what mechanism created the laws and what makes them perfect and critically balanced? Therefore, the Nature alone is not able to create its own laws to create a universe.

Contemporary cosmology is in agreement that the matter of Nature is quantized at its fundamental level. If the matter has not developed properties yet (before creation begins) each component of matter would behave independently to do its own thing to lead to a permanent chaos. No chance of forming a universe.

For a matter conglomerate without preexisting physical laws in it each matter particle is in an inactive equilibrium. This equilibrium extends to the entire matter of the pre-universe. Therefore to have the state of matter changed an extrinsic trigger of energy is needed. In the Vedic Cosmology this trigger is provided by the *Eekshana* of the Creator-Energy-Field. The Creator's *Eekshana* imparts the perfect physical laws (*ritam* and *satyam*) to the system and all properties such as the mass and charge to the matter to begin the creation process.

All thoughts, Vedic or otherwise, consider all substances of the universe to have some property. The difference is in the emphasis on primary versus secondary in that the substance is primary and the property is secondary. The Vedic philosophy puts it as - *the property is sheltered in the substance, is inseparable from the substance and cannot be harnessed out of a substance*. An example of this is the sweetness in sugar. The term *Salilam* for Nature when treated as a substance also means '*a physical entity in dissolved state*'. Implicit in this is that at the starting point of creation the whole matter is non-diverse. In the Veda mantras, the Nature is also addressed as *Aditi* (RigVeda, 10/72/1-9, entire *sukta* is on *Aditi*). The Sanskrit root of the word *aditi* yields - '*the entity for utilization' or* '*the entity for consumption'*. This means that the Nature is utilized in creating the universe and the creation is for utilization. It is utilized in creating cosmos and it is utilized by living beings for forming their bodies and for their survival in general. A RigVeda mantra beautifully expresses that it is the diverse *Aditi* that is seen all around us in different forms.

अदितिर्द्यौरदितिरन्तरिक्षमदितिर्माता स पिता स पुत्र: ।
विश्वे देवा अदिति: पञ्च जना अदितिर्जातमदितिर्जनित्वम् ॥

(RigVeda, 1/89/10)

**Transliteration:**

*"Aditirdyauraditirantariksham aditirmaataa sa pita sa putrah ।*
*Vishve deva aditih panch jana aditirjatamditirjanitvam" ।।)*

**Mantra Translation**:

"*Dyu, the brilliant space around the Sun, is Aditi* (Nature); *Antariksh, the spread-out vast space is all Aditi. Aditi is the mother of all substances, Aditi is the father and Aditi is also its own progeny. All devas are Aditi and five knowledge senses are Aditi. All that is in the universe and all that is to manifest is from Aditi*" (RigVeda 1/89/10)

The Veda in this mantra has encompassed a big range of the creation from the vast space and cosmos to different forces within living beings in the form of knowledge senses and the process of generation from mother to child and so on. All that is in the universe and all new things that will come to be are also *Aditi*. The *Aditi* produces diverse substances but ultimately they all are *Aditi* itself. The thought in the mantra is remarkably simple yet defines uniquely the *Aditi*-entity.

The term *Avidya* for Nature means '*not possessing knowledge*' and the term *Tamah* means an '*inert entity*' and it also means a '*non-knowledge entity*'. Both terms, *Avidya* and *Tamah* for *Prakriti* indicate that *Prakriti* the material-cause of the universe is an inert entity without having any knowledge and its own initiative; unlike-living beings. Such a rich nomenclature in the Vedas for a single entity is an outstanding example in the subject of cosmology. In his Vedic studies, this author has come across numerous synonyms for the Nature-entity, however only 39 of these are compiled in the Table 5.1.

**Table 5.1: Based on its attributes and functions the 39 Sanskrit synonyms of *Prakriti* (Nature)**

| Item No. | Synonyms | Word Meaning | Reference |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | of *Prakriti* (Nature) | | |
| 1 | Aabhu | Nature transited out of its causal form | RigVeda (10/129/3) |
| 2 | Aayu | An aged-entity | |
| 3 | Achetan | without consciousness | Shvetashvar Upanishad |
| 4 | Aditi | *aadyate iti aditi*, utilizable entity | RigVeda(10/72, 1/89/10, 10/64/5) |
| 5 | Agyaan | Nonknowledge | Shvetashvar Upanishad |
| 6 | Aja Ajamekam | Unborn, unitary-eternal | Taittireeya Aranyak (10/10/5) Shveta Upanishad (4/5) |
| 7 | Akshara | Non-decaying with time | |
| 8 | Alinga | Non-descript, neutral gender | Yoga sutra Vyas-bhasya (2/19); Mahabharat, Shanti (303/47) |
| 9 | Anaksha | Blind, devoid of knowledge | RigVeda (10/27/11) |
| 10 | Andham | Blind | RigVeda (10/27/11) |
| 11 | Avyakta | Non-definable (during dissolution phase of creation) | Saankhya; Shvetashvar Upanishad; Kathopnishad (1/3/11); Bhagvadgita |
| 12 | Avidya | Inert, not possessing knowledge | Shvetashvar Upanishad |

| | | | |
|---|---|---|---|
| 13 | Bhogya | Utilizable (matter for cosmos, utilized by souls) | |
| 14 | Chhaya | Image, Shadow, Darkness | Shvetashvar Upanishad |
| 15 | Goh | Cow: provider of nourishment to creation | Vaayu Puraan (23/55) |
| 16 | Jyeshtha | Olden, older than all other objects | RigVeda (10/121/1); Nirukt (13/37) |
| 17 | Kshetra | Field: area with defined space | Shvetashvar Upanishad; Bhagvadgeeta (13/1-5) |
| 18 | Leen-Vastu | Substance that dissolves everything in it. | Saankhya Darshan (1/56) |
| 19 | Mahan | The Great | Mahabharata, Shanti (238/26) |
| 20 | Maaya | Complex to understand, an intended design | RigVeda (6/47/18); Shvetashvar Upanishad (4/10) |
| 21 | Mool | Root-cause of creation | Saankhya (1/32) |
| 22 | Parinamini | Subsistent | Saankhya literature |
| 23 | Pradhaan | Principal cause | Mahabharata, Shanti (238/26); Shvetashvar Upanishad (1/10); Saankhya (2/1) |
| | | | |

| | | | |
|---|---|---|---|
| 24 | Prajapati | Progenitor of population (cosmos), Nature in Creation phase | AtharvaVeda (10/7/7, 8,4 0, 41; 10/8/13); several more |
| 25 | Prakriti | The specific entity that serves as the material cause for creation | Vedas, Saankhya + many references |
| 26 | Prasav dharmini | Embryo-genesis | Saankhya literature |
| 27 | Salakshma | Of uniform properties (pralaya state of nature) | RigVeda (10/12/6) |
| 28 | Salilam | Fluid in nature, pervasive in universe, uniform in properties (pre-creation state of nature) | RigVeda (19/129/3); AtharvaVeda (10/7/38) |
| 29 | Satva | Reality (not an illusion), state in creation phase | RigVeda, Pangi Upanishad |
| 30 | Shakti | Energy | Shvetashvar Upanishad |
| 31 | Svadha | self-sustaining entity, not being created, cause and not an effect | RigVeda (10/129/2, 5) |
| 32 | Tamas/ Tamah | Darkness: non-knowledge entity, inert entity | YajurVeda., Manusmriti (1/5) ; Shvetashvar Upanishad |
| 33 | Tridhatu | Tri-matter or tri-property (sata, raja, tama) | All through Vedic literature |
| | | | |

| | | | |
|---|---|---|---|
| 34 | Tri-gunatmika | Tri-property | Many references |
| 35 | Vun | Presents variety in creation. Utilizable in creation. Diverse as in biodiversity | YajurVeda (1/20) |
| 36 | Vidhanam | Orderly, with rules and physical principles | Deval Dharma Sutra |
| 37 | Vishu Roopa | Of numerous forms | RigVeda (10/12/6) |
| 38 | Vriksha | Tree: It grows, appears in numerous branches, leaves and fruit (as in creation phase). It is cut (as in dissolution phase) | RigVeda (10/31/7, 10/81/4, 1/164/20); YajurVeda (17/20); Taiti San. (4/6/2/5), Geeta (15/1) |
| 39 | Yoni | Material-cause, Womb of all creation, | RigVeda (10/8/3); Shvetashvar Upanishad (1/2) |

Each term in this table generates a different thought about this single entity, Nature. From this pool of words, one can appropriately choose the one that best expresses the underlying thought to create a picture in the reader's mind. In the Table 5.1, a brief meaning of the Sanskrit term is given and references wherever possible are also given in the last column.

Rishi Kapil in his Saankhya philosophy has extensively dealt with the subject of *Prakriti* and the creation of the universe. Rishi Kapil's reference appears several times in the book of Mahabharata (Figure 3.1, Timeline-A, 3140 BCE). The Shanti-parv chapter (63/152*)* of this book presents a reference of an ancient Rishi Yagyavalkya who praised Rishi Kapil and his Saankhya Darshan as - *"Naasti Saankhyasamam Gyaanam*" which translates into – '*There is no knowledge like the Saankhya knowledge'*. It is also stated in Mahabharata that - *"Gyanam Saankhyam param matam*", which translates into – *'The Saankhya knowledge is the profound principle'*.

Upanishads, prior to Mahabharata, have also praised Rishi Kapil and his Saankhya philosophy. This author has cited earlier a number of *sutras* from Rishi Kapil's Saankhya Darshan. Contextually the *sutra*, मूले मूलाभावादमूलं मूलम् (1/32) (*mole moolaabhaavaad-moolam moolam*) was discussed in Chapter 1 explaining the different meanings of the term *mool*. The *sutra* translation is –

*"The mool is without mool due to nonexistence of mool in the mool"*

and its meaning is –

*"The Nature is without a cause due to nonexistence of its cause."*

Implicit in Rishi Kapil's expression is that the Nature is an eternal entity and not an effect of a cause. This is the nature of Nature in the Vedic thought. It is the root-cause of all matter, the *Mool*. The term *mool* is commonly used for the term *jada* which commonly stands for inert substances. The *Prakriti* (Nature) in Vedic science is an inert entity.

As mentioned before, the two states of *Prakriti* are indefinable *Asata* during the pralaya phase and definable *Sata* during its creation (*srishti*) phase.

## *Prakriti* (Nature) a Conglomerate of Tri-property *Aapah* Particles

*Aapah* the fundamental particles of matter in three categories *sata, raja* and *tama* were introduced in Chapter 1 and 2. *Aapah* is one of the most important terms in Vedic cosmology. *Aapah* are the main ingredient of Nature in both its phases, creation and dissolution. *Aapah* are to Vedic physics what is fundamental particles to modern physics. A detailed discussion on *aapah* is presented in the following with a pictorial depiction to differentiate the two states of matter, *Asata* and *Sata*. Mysteriously, the Vedic *rishis* have proclaimed that matter at its fundamental level is a tri-property corpusclized entity, the three properties of the three categories being *sato-guna, rajo-guna* and *tamo-guna* where *guna* suffix to the three kinds of *aapah* stands for 'property'. A brief discussion on the three properties is also included in the following.

## Aapah (आप:): the fundamental Tri-property unit of Matter

The Vedic creation of the universe is from the fundamental form of matter called the *aapah*. The *aapah* in the Vedas appear as a pluralized term in female gender (RigVeda, 7/47/1-4). Therefore, *aapah* term in this text is not pluralized by adding 's' to it. *Aapah* are pluralized in the Vedas perhaps because even the formation of a single atom of matter needs more than one *aapah* and the female adjective to *aapah* perhaps is because they together give birth to the whole creation when impregnated by the *Eekshana* energy of the Creator.

An *aapah* particle of the Veda is with independent existence in the likeness of a quark of modern physics that are formed right in the beginning of the Big Bang and are consumed in forming the nuclear particles leading to the formation of atoms and molecules. Formation of the smallest atom, Hydrogen, with two 'up-type' and one 'down-type' quarks was depicted in Figure 2.3 in Chapter 2. The Vedic philosophy stipulates that no particle is formed without the *aapah* particles. This implies that a negatively charged electron orbiting around a nucleus is formed with some *aapah* particles and even a photon of light presently thought as a mass-less particle is also formed with some *aapah* particles. An electron being only $659^{th}$ of the mass of a quark mass it is likely that an *aapah* particle is even smaller than a quark or even smaller than an electron.

Notice that the *Sata*-state of matter in the creation phase and *sato-guna* (*sata*-property) of matter use the same term '*sata*'. To keep a distinction between the state of matter and the property of matter, this author has used first syllable in upper-case for the *Sata*-state of matter and the lower-case for the *sata*-property of *aapah* particle. In the Vedas, the context determines whether the state of matter is being addressed in a mantra or the properties of matter are the subject. For example in the RigVeda *sukta* (10/129/1) on Creation of the Universe, both terms *Asata* and *Sata* have appeared together in the same Veda mantra, where the context is the state of matter transiting from *Asata,* the indefinable state of matter, to *Sata*, the defined state of matter. In context with the property of matter the word *sata* or *satah* is for the property of matter, the other two being *rajah* and *tamah*. As mentioned above, these properties when hyphenated with the term *guna* (property) their Sanskrit transition is: *sato-guna, rajo-guna* and *tamo-guna*.

A coarser example of *guna* (property) from the observable world is the sweetness in sugar. When a tiny sugar crystal is broken into smaller pieces, each piece still tastes sweet. Even a single sugar molecule will taste sweet. A sugar molecule is made up of three types of atoms, Hydrogen, Carbon and Oxygen. None of these individually taste sweet. Therefore, if a sugar molecule is broken into Hydrogen, Carbon and Oxygen atoms, the sugar molecule loses its identity and its sweetness too. Other chemicals are also formed with differing Hydrogen, Carbon and Oxygen atoms but they have other *guna*, yielding other tastes or smells (properties). It is a special chemical arrangement of these atoms that creates a specific *guna* in a substance. What this coarse example of sugar tells us is that the *guna* of a substance accompanies the substance right to its final minuteness. The three *gunas* stated above take us well beyond the *gunas* of taste and smell at atomic and molecular level. The *sato-guna, rajo-guna* and *tamo-guna* are the *gunas* (properties) of the most fundamental form of matter beyond the atoms and molecules (*paramanu* and *anu*) of elements and therefore beyond the subject of knowledge senses. An *aapah* particle with three *gunas* in it indicates that it is a trio with three types of particles in it.

Vedic principles stipulate that during the creation phase of Nature, differing proportions of *sata, raja* and *tama* create substances (atoms and molecules) with differing properties. This is something similar to differing proportions of nuclear particles in the nucleus form different atoms.

The observable active matter/energy of cosmos is said to be dominant in *rajo-guna*. It is the *aapah* of *rajo-guna* property that serves as the seed for the formation of observable matter in the creation. This is why in common language, the fine sand grains are addressed as *raj* (sound as in nudge). The basic property of matter being gravitational attraction, it is the *rajah*-property of matter that creates gravitation in matter. The orbital motion in cosmos is also credited to *rajo-guna*. This motion in physics terminology is owing to the kinetic energy. The radiational energy (light) is also owing to the *rajo-guna*. The resplendence cosmos in motion are addressed as "*yo antarikshe rajaso-vimanah*" (YajurVeda, 32/6) which translates into, "*those matter-objects in Space, in flight like energetic plane*".

In Vedic science, the intellect in living-beings is a separate entity acquired by living-systems from the pervading field of *aapah* with *sato-*

*guna*. Since the intellect entity is a byproduct of *aapah* it is a physical entity.

Matter made of *aapah* with non-active comatose characteristic is said to be dominant in *tamo-guna*. Keeping this in mind a reference from Kapil Rishi's Saankhya Darshan on the state of *Prakriti* (Nature) in its dissolved state is briefly discussed.

## The *Saamyavastha Prakriti*: State of Neutrality in Nature

Rishi Kapil lays down a canon defining the state of *Prakriti*. The first part of the *sutra* that deals with the *Prakriti* and its products is,

सत्त्वरजस्तमसां साम्यावस्था प्रकृतिः,...

"S*atva-rajs-tam-saam saamyavastha prakritihi*..." (Saankhya, 1/26)

**Sutra Translation:**

*"The saamyavastha (balanced, with neutrality) state of satva, rajah, tamah is Prakriti..." . (Saankhya, 1/26)*

Rishi Kapil in this formulation states that the *Prakriti* is in its dissolved state when three properties of matter, are in a uniform balance, indistinguishably mixed together. This state is when the three properties of matter exhibit no diversity, no separation or no activity in any fashion. This is Nature's *Asata*-state which is the dissolution phase in a non-diverse state of the three *gunas* (properties). This is matter's indefinable state. This uniform and non-descript is the state from which the Nature enters into the creation phase. To understand Rishi Kapil's *saamyavastha* (balanced state) of Nature a parallel from modern physics is drawn in the following.

A system in physics is said to be in static equilibrium when no movement is observed in it or in its parts. This would occur when there are no forces acting on the system or all forces acting on the system in different directions cancel out to zero. Assume this system to be a container with some gas in it. By itself sitting on a table the container is in static equilibrium. Inside the container however the story is quite different. The gas molecules inside the container are not stationary, they are moving around at high speeds. The cause of this motion is the temperature of the

system. In Chapter 2 while discussing temperature of a substance the 'absolute zero temperature' (0° K) was explained. This is the temperature when motions of all atoms and molecules of the substance cease to exist. Such a state will render static equilibrium of even higher degree than the one mentioned above. The question is whether this really is the highest state of static equilibrium of a substance? Certainly not and this is still not the *saamyavastha* of *Prakriti* in Rishi Kapil's definition either. Further discussion on this makes it clear.

Consider a stationary atom in the system at static equilibrium. This stationary atom in fact has tremendous dynamics because the tiny electrons are ceaselessly orbiting at very high speeds around its nucleus; reaching over 2000 km per second. This means that apparently a system in static equilibrium at 0° K still had a high degree of dynamics hidden in it. The difference in this static equilibrium and Rishi Kapil's *saamyavastha* equilibrium is that there is no motion of electrons or the existence of any activity in Nature (matter) even at its fundamental level. The *'saamyavastha'* state of Nature in Rishi Kapil's *sutra* is not an ordinary equilibrium state; rather it is the state when even the fundamental particles of matter have no motion of any kind whatsoever. By the Vedic definition, any motion in matter represents the presence of *rajo-guna,* which if existed, would disturb the *saamyavastha* state of Nature. In the realm of particle physics and the Big Bang Theory, it could be the state before Plank Time. It is that point of equilibrium beyond which, as in the rest of the *sutra* (not presented above), the *Prakriti* enters into creation phase producing a set of 23 entities of matter at the most subtle matter and energy forms. These first-born distinct subtle forms of energies serve as the foundation for creation of the Vedic universe which includes both, the animate and inanimate creation.

The emphasis in the sutra is the 'balanced state' of *satva, rajah, tamah* in the inert conglomerate. This state is also expressed as the inactive state of *Prakriti* that should continue to persist unless an extrinsic spark of energy is put into it.

The infusion of energy into the balanced state of matter (*saamyavastha* of *Prakriti*) by the *Purush*-entity at a given point in time causes a reversal in the non-active nature of matter into becoming active.

This Vedic concept of Nature wherein it is an ensemble of three types of particles at its fundamental level is unique to the Vedas. Just as in modern cosmology the universe starts as an uncharged neutral singular blob

of matter in its early state and later it exhibits a charge separation as in an atom where its nucleus is positive and electrons orbiting around it are negative. If all charges of the universe, positive and negative, are summed up, it is a neutral entity. This separation of charge is the nature of the universe in creation phase. Likewise the separation of three *gunas* to form substances dominant in specific *gunas* is the Vedic concept of the universe. A simplistic example for the *Asata*-state of matter in Nature's balanced state in dissolution phase during *pralaya* is a sesame seed. Just as the three ingredients, sugar-oil-chaff, are uniformly hidden in a sesame seed, the three properties *sata-rajah-tamah* of matter are uniformly hidden in Nature. The diversification of sugar-oil-chaff is observed when the sesame seed is crushed by extrinsic force. This is in the likeness of the creation phase of the universe where the balanced state is disturbed revealing its diverse properties.

## Etymology of the term *Aapah*

The great grammarian of Sanskrit, the scholar and reviver of the Vedas, Swami Dayanand Sarasvati (1825 - 1883 CE) has provided the root and the word formation of the term *aapah* in his book entitled 'Panch Maha Yagjya Vidhi'. He states:

*" ..The word aapah is derived from* अप (*ap*), which *originates from the root* आप्लृ व्याप्तौ (*aaplri vyaptau*) *and in the realm of physical creation it is always feminine and plural..."*

Swami Dayanand Sarasvati further elaborated upon the term *ap* (pronunciation as in 'up') when he took up the translation and interpretation of an AtharvaVeda mantra. The root meaning of the term *ap* is contained in the second part of the root *vyaptau* of *aaplri vyaptau*. This means that *aapah* are 'all-pervading'. The term to represent something which is all-pervading/ubiquitous, is व्यापक (*vyapak*), also derived from the root व्याप्तौ (*vyaptau*). The term व्यापक (*vyapak*) itself is formed with वि आप क (*vi aap ka*) with अप (*ap*) being at its core. Owing to the property of all-pervasion, the *Brahmn* (Creator-entity) is addressed with the adjective of सर्व-व्यापक (*sarva-vyapaka* = all-pervading) with *ap* at the core of the second term. Even though the Vedic Creator-entity is an all-pervading singular unitary

spirit, the *Brahmn* is also addressed as *aapah* in singularity. When the context is the physical aspect of the creation, the *aapah* are addressed in plurality with feminine gender. The usage of the word in a sentence determines the context.

The *rudhi* meaning (ordinary or colloquial) of the word *aapah* also stands for water because fluidity is water's basic nature. The word *aapah* appears very frequently in the Veda mantras on cosmology where early stage of the universe is depicted. There was no water formation in that early stage of creation and water is not all-pervading in the universe. Therefore, the *yaugik* meaning (root-meaning) of the term must apply.

## Aapah the Viscosity of Space

The term *aapah* having generated from the *dhatu* (root) आप्लृ व्याप्तौ (*aaplri vyaptau*) necessitates that it is ubiquitously present at every point in space. Based on this definition and from other references in the Vedas this author has understood that out of the seven progeny of *Aditi* (Nature), discussed in Chapter 5 and 8, the *aapah* is one of the first born *devatas* with the property of ubiquity. Therefore *aapah* by itself is an entity and no corner of space is devoid of it. The space in between the stars and galaxies that one thinks is empty is in fact populated by the background *aapah* field. This field acts as the viscosity of empty space and moderates the motion of all moving objects from massive celestial bodies to high speed fundamental particles like photons. The reason a photon of light travels with a fixed speed of $3x10^8$ meters per second in vacuum and not more is due to the ubiquitous field of *aapah*. A photon is made of *aapah* and therefore must have some mass. Therefore, it also must exhibit gravitational attraction to mass. Its speed through the *aapah*-field limited to $3x10^8$ meters per second is indicative of the fact that the mass distribution in space within the *aapah*-field affects the motion of the photon.

### The nature of *Aapah*

Here is a reference from Taittireeya Aranyak, written after Saankhya Darshan, where the same three inherent eternal properties of Nature, *satah*-

*rajah-tamah* as being the cause of the creation, are expressed beautifully with the adjective of colours.

अजामेकां लोहितशुक्लकृष्णां बव्हीं प्रजां जनयन्तीं सरुपां।
अजो ह्येको जुषमाणोऽनुशेते जहात्येनां भुक्तभोगामजोऽन्य ॥
(Taittireeya Aranyak, 10/10/5)

**Transliteration:**

"*Ajaamekaam lohit-shukl-krishnaam bavhim prajaam janyanteem sarupaam*/
*Ajo hyeko jushmaano anushete jahaatyenaam bhuktbhogaamjo-anya"*॥)

**Translation:**

> *"With the* (fundamental) *properties of lohit-shukl-krishn is one and the only one Aja* (Nature) *that itself never takes birth but from it are created numerous diverse populations that inherit the same properties. Among the eternal-beings* (souls) *one* (kind) *utilizes Aja to enjoy materialism and continues to be trapped in it and the other* (kind) *utilizes it to gain access for the enlightenment of the Brahmn, thus liberating himself from it and attaining salvation."* (Taittireeya Aranyak, 10/10/5).

In the above *shloka* the *lohit* (red), *shukl* (white) and *krishn* (black) respectively correspond to the three fundamental properties of Nature, the *satva*, *rajas*,and *tamas*. The three fundamental properties of matter are the same as stated before. This shloka also unfolds that the tri-property Nature is one entity and is utilized to create the cosmos to populate the universe with all objects of Nature inheriting the tri-property of the parent. The second line of the shloka refers to the eternally existing conscious beings (third invariant to be defined below) that are born in physical bodies in Creator's creation to utilize Nature and its creation. As mentioned before, Nature acquired the synonym of *Aditi* because it is for utilization by conscious-beings. The Taittireeya statement cited above states figuratively that one kind of conscious-being, while utilizing the Nature, is caught up in

it and the other kind becomes cognizant of the fact that the Creator and the creation (Nature) are two different entities. This realization by the enlightened conscious-being frees him/her from the attachment to matter (Nature) and leads him/her to salvation, the so-called 'eternal bliss'. Simply put- the materialism is a hindrance to knowledge and enlightenment and therefore to the salvation.

The first word *Aja* of Taittireeya *shloka* is a noun and stands for an entity that never takes birth, meaning that it is an eternal entity. *Aja* of Taittireeya is the Nature-entity and the three adjectives to it (red, white, black) are its three causal properties of *satah, rajs,*and *tamah* respectively that in Kapil's sutra are listed *sata, raja* and *tama*. The difference here is that the writer of the Taittireeya Upanishad expressed them with adjectives of colours. Since the colours are present only in inert matter and not in the *atma* (soul) of a conscious-being, the entity with three colours (three properties) is inert and produces many populations out of these three fundamental properties of matter that are inert like itself. Acharya Udayaveer Shastri in his book in Hindi language, 'Saankhya Darshan Ka Itihaas', has elaborated upon this topic with detailed etymology of different terms.

Pandit Bhagvaddatta in his book 'Ved-Vidya Nidarshan' (1959) summarized from the fifth chapter of Vayu Purana shlokas 9 through 13 that draw a sketch of Vedic creation of the universe. The English translation of the same is given below:

> "*The pralaya* (dissolution) *is when the gunas* (three properties of matter: *sato-guna, rajo-guna, tamo-guna*) *are in a non-differentiating balanced state of dissolution and srishti* (creation) *is when the balance is perturbed. The rajo-guna in pralaya exists in indefinable dissolved state, sheltered in tamo-guna and sato-guna like oil in sesame seed and butter in milk. Parameshvar* (the Supreme Being) *with immense yoga* (action with conscious effort) *entered the egg* (primordial matter embryo), *created perturbation in the Pradhaan* (Nature) *and the awakening in All-pervading Purush self. The perturbation in the Pradhaan manifested the rajo-guna. It is the rajah that creates exalted action in all, like water sprouting a seed. Under the governance of Purush, incongruous state of the gunas* (properties) *creates the srishti* (universe)".

Although the Puranic references are not as old as the references from the Vedic literature of pre-Mahabharata period 5,000 years ago, the ideas contained in them have descended from ancient Sanskrit Literature and remain indigenous to India where Nature continues to be defined as *tri-guna-tma-ka* (tri-property entity). As far as the above statements of Vayu Purana on creation are concerned the underlying thought is not different from that in the Vedas and the Darshans. According to the Vayu Purana the equilibrium state of the three properties of Nature is when there is a complete lull in Nature. It becomes active upon inspiration from the Creator.

Of the three properties the rajo-guna that was masked earlier by the other two, becomes free to create dynamic state in matter. This new dynamics in the primordial matter creates various subtle forms of matter some of which with the nature of ubiquity. Rishi Kapil has enumerated the forms and the sequence of these forms. One matter form dominant in rajo-guna is Ahankaar (ego), a force generating activity in all, animate and inanimate.

It is the *rajo-guna* that imparts the property of mass in matter leading to the property of gravitational attraction with motion at large scale in heavenly bodies and at small scales in atoms to rotate the electrons around nuclei.

The Nature in the above statement being compared to an egg indicates that in its early state the Nature was a three-dimensional entity in space in the shape of an ellipsoid. Large number of Veda mantras and Brahmana statements, presented in Chapter 7 and 8, emphasize that the primordial matter of the universe (*Prakriti* = Nature) was initially in the shape of an ovate in *paryaplav* (rotation in floatation) before it exploded in the Vedic Big Bang. This is contrary to the modern Big Bang hypothesis where the whole nature is in a dimensionless point; a non-physical state only possible in mathematics. The *aapah*-trio with the three properties of *satah, rajah* and *tamah* are pictorially in Figure 5.1). The colours white, red and black for *satah, rajah* and *tamah* particles are arbitrary; however, they are adopted from the Taittireeya Aranyak citation presented above.

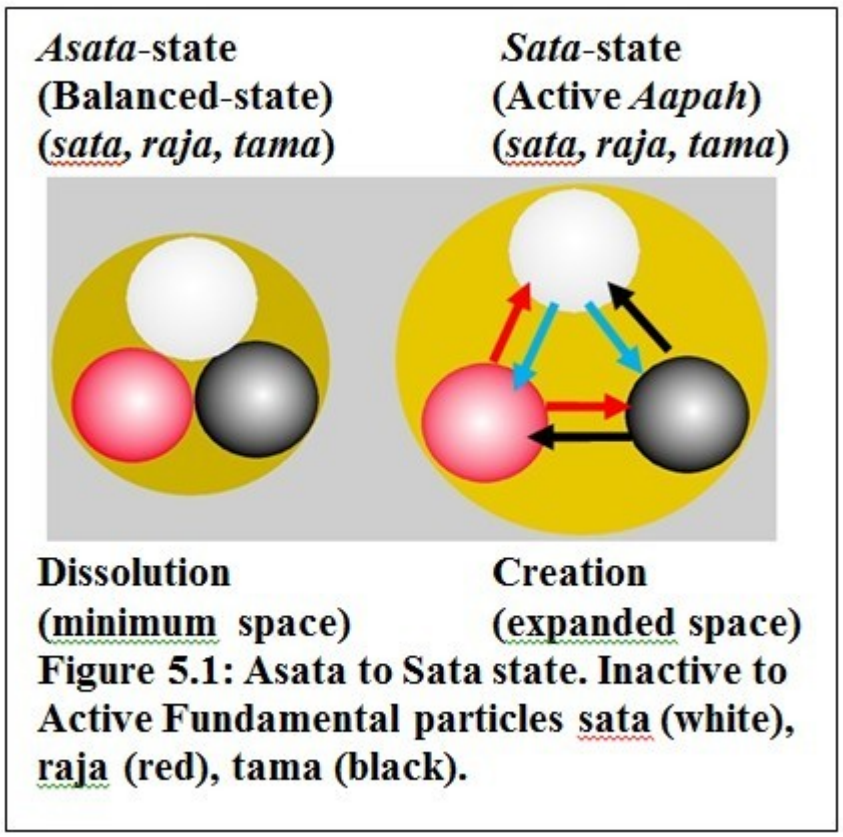



**Figure 5.1: Asata to Sata state. Inactive to Active Fundamental particles sata (white), raja (red), tama (black).**

This author's concept of *Asata*-state is shown on the left in Figure 5.1. The active tri-property *aapah* particle in Nature's creation phase is shown on the right of Figure 5.1. Based on the Vedic knowledge grasped by this author, all forces of Nature are absent in its *Asata*-state of dissolution phase and they come into existence when *Asata*-state switches into the *Sata*-state of creation. The figure on the left is devoid of any kinetics in *aapah,* external or internal, leading to all *satah, rajah* and *tamah* to come together and confine in *a* diminutive space, reducing the space around them (shown by outer circle in the diagram). In the creation phase on the other hand, the differing forces (attractive and repulsive) emerge as byproducts of Nature (represented by arrows) that disturbs the balance in Nature leading to separation between the *satah, rajah* and *tamah*, stretching the Space-entity occupying increased volume (shown by outer circle).

The concept presented in the above diagram for two states of *aapah* particles when extended to the whole Nature, leads one to conceptualize matter of the universe confined in a smaller space during its dissolved phase and it swelled up in its creation phase. This is what is expressed in the

RigVeda mantra (1/129/3) in the *Bhavavrittam sukta* (History of Creation of the Universe) that the *Prakriti* (Nature) in its *Asata*-state is confined *in 'tuchchhayen'* (diminutive) space. This is further discussed in detail in Chapter 6. The matter particles in the creation phase transit from 'introvert' to 'extrovert' due to the *tapah* (heat energy) of the Creator Energy Field (RigVeda, 1/129/3; 1/190/1). It is therefore intuitive to suggest that the energized *aapah* would stretch the Space of the embryonic universe.

A nuclear scientist coined the word 'flavor' for describing the property of a quark (Table 2.0) even though a quark has no taste in it. Still the Figure 5.1 draws a parallel with physics in that the up-type and down-type for quarks is something similar to the up and sown arrows differentiating *satah* (white), *rajah* (red) and *tamah* (black) particles. In reality these three particles are colourless.

The *aapah* are said to be the un-exhausting fuel of the creation, the onset of which is said to begin with the onset of vibrations in *aapah*. These thoughts are presented in the RigVeda mantra:

आपो यं व: प्रथमं देवयंत इन्द्रपानमुर्मिम[1]कृण्वतेळ: ।
तं वो वयं शुचिमरिप्रमद्य घृतप्रुषं मधुमंतं वनेम ॥

(RigVeda, 7/47/1)

**Transliteration and Word Translation:**

आपो (*aapo) = aapah (pluralized)* , यं (*yam*)= to which , व: (*vah*) = your, प्रथमं (*prathamam*) = the first, देवयंत (*devayanta*) = desiring *devas,* इन्द्रपानम् (*indrapanam*) = remunerative to *Indra deva* (electricity) , ऊर्मिम्[1] (*urmim*) = waves or vibrations, अकृण्वत (*akrinvat*) = to prove or to draw inference with contemplation, इळ: (*ilah*) = voice, action with controlled deliverance ।
तं (*tam*) = that , वो (*vo*) = for you , वयं (*vayam*) = we , शुचिम (*shuchim*) = pure, अरिप्रम् (*aripram*) = without defect, अद्य (*adya*) = today , घृतप्रुषं (*ghritprusham*) = saturated with fluidity, fuel, मधुमंतं (*madhumantam*) = elating substance, वनेम (*vanem*) = with specificity॥

**Mantra Translation and Interpretation**

> *"Today let us be contemplative to draw inference on aapah the elating substance that is fundamentally pure without defect and is the un-exhausting fuel with fluidity (ghrit-prusham). The controlled first vibrations*[1] *(ilah-urmim*[1]*) in aapah were for the desiring devas and were remunerative to the Indra deva (electricity)".* (RigVeda, 7/47/1).

The reference to *devas* in the mantra with the adjective of 'first' is for the first specific energy and force fields created in the Vedic creation process that lead to the next steps of creation in the universe. One of the seven *devas* created first in the beginning of creation, discussed in detail in Chapter 8 is the *Indra-devata*, the all-pervading electricity of the universe.

First of the 7 *devas* is *Aapah-devata* itself the matter at its most fundamental stage which is the subject of this mantra. The adjective of 'pure' to *aapah* particles forming the *Aapah-devata* means that it is an unadulterated primordial matter. The 'purity' of *aapah* here means that it is made of itself without components and before any degenerate states of matter are formed out of them. Since *aapah* are the source of all other forms of matter and energy, observable and unobservable, they are addressed with the adjective of घृतप्रुषं (*ghrit-prusham*), the unlimited fluid fuel of the universe; the *Indra* being one of the first beneficiaries of it to manifest as electricity.

An important and mysterious term in the mantra is ऊर्मिम्[1] (*urmim*) in the primordial *aapah*. The term *urmim* stands for both, waves and vibrations. As it will become clear later from the other mantras that the cause of the first vibrations in the fundamental matter of the universe is *tapah* the heat energy from a source extrinsic to *aapah*, this mantra hints that the initiating mechanism for the creation of the universe is through the vibrations. These first vibrations give rise to the first seven *devas* which become the fundamental properties/nature of matter. These seven *devas* are

the subject of the *Devata sukta* of RigVeda (10/72/1-9) discussed in the Chapter 8.

When the Vedic term '*indra*' is subjected to etymological analysis, one learns that its root represents properties that represent several entities. In the context of *devas*, the *indra* among seven inert systems of creation represents the all-pervading electricity of the universe. From a practical perspective, one knows that the electrons, the representative of electricity, pervade through all matter of the universe and even the energy (photons) is produced by electrons when they transit from higher exited states of atoms to lower states. Therefore, an electron and differing forms of electricity are in the category of *indra-devata*.

The controlled ऊर्मिम् (*urmim*), the waves and vibrations in *aapah* leading to the creation of *indra-devata*, the electricity, is the subject of this mantra. The waves and vibrations in all-pervading electricity are also the subject of the sixth mantra of the *Devata sukta* (RigVeda, 10/72/6). Stated therein is - 'यद्देवा1 … नृत्य2तामिव3 तीव्रो4 रेणु5रपायत6 (*yad-deva1 … nritya2tamiva3 teevro4 renu5rpaayata6*), which means – "*The devas[1]…with their each primordial fundamental quantum[5], spread[6] out forcefully[4] far and wide through this universe moving like[3] a dancer[2]"*. The dance of particles in the early minute form of matter is ऊर्मिम् (*urmim*), the waves and the vibrations mentioned in this mantra. Implicit here is that the first vibrations in *aapah* the inexhaustible fuel of the universe create the first *deva*-systems. The other mantras of the *Aapah-sukta* of RigVeda (7/47) have also re-emphasized the ऊर्मिम् (*urmim*) in the *aapah*. In RigVeda (7/47/2) the mantra states that the ऊर्मिम् (*urmim*) the vibrations in the *aapah* cause आशुहेमा इन्द्र: (*aashuhema indrah*) meaning *'a tremendous increase in indra* (*the electricity*)*'*. When it comes to the creation of the universe, the thoughts presented above and other related mantras are mysterious yet quite explicit in picturing the process and relationship of entities playing a role in the early stages of the universe. This author has made an effort to draw attention to the processes and relationships of the entities that are involved in the Vedic Cosmology scenario.

With regard to the Nature as a tri-property entity several Upanishads have followed Rishi Kapil and his Saankhya Darshan. In Chapter 1 a reference of the students of Rishi Shvetashvatar, the author of the

Shvetashvatar Upanishad, was cited wherein they had posed a question to their teacher asking which entity is most important in creating the universe. In Shvetashvatar Upanishad (5/2, 4/5), the Vedic *maatatli* (cosmologist) Rishi Shvetashvatar expressed high respect for Rishi Kapil and his Saankhya Darshan and proceeded defining the Nature as the tri-property entity, in a way quite similar to the one presented by Rishi Kapil. The same is in Chhaandyoga Upanishad (6/3/3, 4 and 6/4/7). So there is no dearth of discussion and consistency on Nature's nature in the Vedic literature. Not only the Upanishad references put Rishi Kapil in the distant past of the Upanishad period in the Vedic history, the Upanishads, Darshans, Mahabharata and the other ancient books propound Rishi Kapil's philosophy on the fine structure of the Nature-entity. Rishi Kapil of course has based his philosophy on the Vedas.

Yogiraj Krishn in Bhagvadgita stated that Rishi Kapil's Saankhya principle based on the Veda, that the Nature is a tri-property entity, is the '*all-accepting principle*'. Bhagvadgita's '*tri-gunya-vishaya veda'* (tri-property-subject of Veda) in its shloka (2/45) is also a reference to Veda's tri-property Nature where Krishn preaches to Arjun to separate himself from *Prakriti* to strengthen his spiritual vitality. This is exactly the same as the message in Taittireeya Aranyak shloka for salvation. Krishn in the Bhagvadgita shloka (13/23) further emphasizes the subject of '*Purush-Prakriti*' (Creator-Nature) very close to what was in the shloka of Taittireeya Aryanak. He preaches about the hidden secret for attaining salvation. This secret is to attain freedom from being trapped in the material body with limitations, through the cycle of reincarnations which is known as the bondage of Nature (matter). In the present context of a discussion on the tri-property Nature, it is interesting to learn that Lord Krishn stated to Arjun in Bhagvadgita shloka (14/5) explicitly the effect of matter on the soul. The shloka translation reads thus:

> *"O Mahabahu!* (Arjun, the warrior with great arms) *the satva, raja, tama, properties of the Prakriti* (Nature) *tie the imperishable conscious soul by bestowing a physical body to it"*. (Bhagvadgita, 14/5).

Krishn's message to Arjun may sound as though the Nature entity has its own mind and registers control to tie down an eternal-being soul to the

material pleasures of the physical body, thus diverting the soul away from eternal bliss of salvation. It has been emphasized severally in this text that Vedas treat Nature, its byproducts and its systems (*devas*), as inert entities. Krishn makes a distinction here and throughout the Bhagvadgita that the soul is conscious and is an imperishable entity while the physical body derived from *Prakriti* is transient. The inert entity like Nature and its other inert systems like air, energy, Sun, Earth and so on are also inert.

# Vedic Triune Atom

According to modern physics the inherent nature of matter is corpuscular. An atom may have several neutrons and protons forming its nucleus. Each proton or neutron is formed with three quarks each; a proton formed by two up-type and one down-type quark and a neutron is formed by two down-type and one up-type quark. When an electron is $659^{th}$ in mass of a quark it cannot be said that a quark is matter's last stage. An interesting observation in modern physics is that a triplet of matter (3 quarks) gives rise to stability in forming matter.

A remarkable feature of the ancient Vedic science is that the corpuscularized (made up of fundamental particles) Nature at its fundamental level is made up of three types of particles *sata*, *raja* and *tama*. However, based on the discussion on matter in the Vedic Literature, descending down from the ages, this author understands that each component of this Vedic triplet is subtler than the stable particles observed and measured by modern physics. This author posits even the mass-less photon, a particle much smaller than a quark, must have at least one *rajah* particle in it. We have not seen yet what is inside a quark leave alone what is inside a photon.

For a moment let us assume that a quark is not the fundamental particle but it is divisible into smaller particles of matter. A quark weighs about $6x10^{-28}$ kg (6 divided by a number with 28 zeros after 1) and an electron weighs about $9.11x10^{-31}$ kg (about $659^{th}$ of a quark). We can at least divide a quark, hypothetically, into 659 little pieces with each piece weighing the same as an electron. But why stop at that. Another real particle in modern physics called neutrino weighs only about $1.78x10^{-37}$ kg which is about 3.37 billionth of a quark. The Big Bang Hypothesis uses the time division up to $10^{-43}$ seconds (Plank-time). Therefore, if time-division that small can make sense in physics, no mathematical limit could be imposed on dividing matter well beyond the size of a neutrino. Thus if one continues to divide a quark to reach a trillionth of its mass, one ends up with a tiny piece of matter with some matter still left in it. So, we are left with two questions:

(a) are the *sata-raja-tama* of the Veda the same as the neutron-proton-electron of the contemporary physics? Or

(b) are the *sata-raja-tama* of the Veda the same as the three quarks of contemporary physics that form a neutron or a proton?

These are difficult questions to answer. One other pertinent question is – how did the Vedic *rishis* reach the conclusion that the fundamental particle of the Vedas is a triplet of three particles of different properties?

The Vedic term for an atom is *paramanu (param+anu)*. The prefixed adjective *param* to the suffix *anu* means the ultimate reality of *anu* or 'beyond an *anu*'. In the Vedic concept the unit of *aapah* is said to be *tri-gunatmaka* (tri-property), indicating that the separation in the three properties is a possibility. A *paramanu* on the other hand is said to be the last state of matter. Therefore a Vedic *paramanu* is either a *sata* particle or a *raja* particle or a *tama* particle. In Vedic concept a *paramanu* by definition is that entity of matter which is not divisible further. More than one *paramanu* form an *anu*. This distinction is similar to the one used for an atom and a molecule in modern physics.

The Sanskrit term *anu* stands for the antonym of 'fat'. This means that an *anu* is not fat yet with extra matter in it. which also means that it is fater than a *paramanu* and can still be fater. It is implicit in an *anu* that it is a three dimensional substance. By fat here is not meant butter. Therefore an *anu* is a single molecule of a substance made up of several individual fundamental *paramanus*. This is the understanding throughout the Vedic literature. The euphonic combination of *param* + *anu* forming *paramanu* therefore refers to the last stage of *anu*. Nature as a whole is eternal and exhibits continual change during its creation phase forming atoms and molecules and their aggregates in the form of cosmos. However, *paramanu* being the last minute state of matter, it is a *nitya* entity, which does not change with time. These unchanging smallest units of matter make the *Prakriti* as a whole, an eternal entity.

With regard to the physical shape of a *paramanu*, Rishi Kanaad in Vaisheshik Darshan has stated the nature and feature of a *paramanu* as, नित्यं परिमण्डलम् (*nityam parimandalam*, Vaisheshik, 7/1/20). This translates into - "*eternal and spherical*". The eternity (*nityam*) is the nature of a *paramanu* and sphericity is its physical shape. In Figure 5.1 an *aapah* trio of *sata, raja*

and *tama* is depicted. One cannot form a परिमण्डलम् (*parimandalam* = *spherical*) particle with two or more spherical particles. Therefore, Rishi Kanaad's definition of a *paramanu* necessitated that it is a single spherical entity. Therefore, it becomes obvious that *sata, raja* and *tama* each are the state of a *paramanu*, the last stage of matter. Implicit in Rishi Kanaad's definition of *paramanu* being "*nityam parimandalam*" is that through the eternal cycle of creation and dissolution of the universe when Nature goes through change of state, *Sata*-state to *Asata*-state, a *paramanu* does not change. For a *paramanu* to be *nitya*, a *sata* or a *raja* or a *tama* particle has to be indivisible. Thus these three are the ultimate building blocks of Nature and the Vedic defined Nature is equally divided into three types of particles with three individual properties.

In the Vedic philosophy larger *anu* (molecules) of different substances are formed by combining differing proportions of *sata, raja* and *tama*. In the context of describing elements, the Vedic philosophy uses the terms *parmanu* and *anu* in the same way as the terms 'atom' and 'molecule' in modern physics. The difference however is that the Vedic definition pertains to a finer stage of matter than in modern physics. The term 'atom' in Modern Physics does not represent the *nitya* virtue (eternity) of the matter particle because in reality all atoms of elements are newly formed during this creation process of the universe and will ultimately dissolve into fundamental particles.

The term *guna*, the property in a substance, indicates that it is associated with the substance that already exists. When the term *guna* is used in the realm of the creation of the universe the word *guna* in the context of metaphysics and philosophy is synonymous with the particle (matter) itself. In the Vedic creation of the universe the material-cause for the onset of creation is Nature as a whole, but at a finer level it is the triplet of *gunas* (properties): *sato-guna, rajo-guna* and *tamo-guna* that reside in the three types of particles *sata, raja* and *tama* forming the Nature-entity and therefore these *gunas* are addressed as the cause for creation. In a euphonic conjugation these three *gunas* (properties) are written as *satoguna, rajoguna* and *tamoguna*. This is equivalent of saying that the matter at its fundamental state is triune.

## Physical Aspect of the Triplet

The Vedas recognize energy forms in both realms, physical and metaphysical. The examples of the enrgy forms in the physical realm are *agni or taapah* (heat-energy), *indra* (electricity) and *vaayu* (kinetic-energy) and so on. Contextually the *eekshana* force/energy associated with the consciousness was briefly discussed in this Chapter and will be elaborated upon in Chapter 6 Volume 2. The Vedic philosophy considers a whole set of energy forms in metaphysical realm (to be discussed in a separate book). These most fundamental subtler energy forms are byproducts of matter, dominant in *satoguna* (*satah-aapah*) are addressed with adjectives such as *devata, rishis, hotas, indriyas* and so on; even though they are all inert energy functions. These energies exert their own forces in specific fields wherein they function. Vedas and the Vedic philosophy propound that the five *tanmatras* of *Ahankaar-tatva* (Ego-element) lead to the creation of matter and physical energy forms. It is the dominance of *rajoguna* that creates most activity in the matter leading to the observable form of matter. In Vedic philosophy the dynamic nature in observable universe is owing to the dominance of *rajoguna*. It is the *rajoguna* that creates observable matter that has *roop* (form and shape) and *guna* (property) like the mass in matter. For example the Vedic way of expressing the Sun-Earth system in terms of *rajoguna* would be – Sun's *rajah* keeps the Earth attracted to it. Therefore, although the gravitational force is minute enough to be termed as a *devata*, it is still said to be due to *rajoguna* in matter.

Even though the life on Earth and on other *lokas* (the other worlds in the universe) according to the Vedic creation is said to have appeared later in the creation, the physical creation of celestial objects is considered to be secondary. The physical creation is only a preparation for life to emerge in it. Also since the conscious-beings need physical body (matter) to function in this creation the tri-property in matter must relate to the living creation also. In the Vedic philosophy therefore, the overall nature of a conscious-being is determined by given proportions of *satoguna, rajoguna* and *tamoguna* in his/her persona. This is briefly discussed further.

## Spiritual aspect of the Triplet

The basic nature of matter does not alter whether enormous cosmos and solar systems are formed out of it or small living bodies grow out of it. Hydrogen atoms forming the stars of the Milky Way Galaxy are similar to

those forming water and other organic molecules in a living cell of a living-being. The amazing thing in all this is that the complexity in chemical compounds formed in an enormous star is not enormous compared to the inordinate complexity in forming and functioning of a living cell of a small living-being. The automatic functioning of the thousands of different sub-functions in a living body and the maintenance of complex chemical structures, including DNA differentiating one from the other, are completely absent in the enormity of a star. The complexity of the living body disappears at its death. The presence of the complexity in the living body is due to life in it and this life's conscious effort, while it is present in the body. In Vedic expression the complexity of the living body is due to the presence of the quantum of consciousness in it otherwise known as the spirit (*atma*) and the development of enormous complexity is the minimum requirement for the ownership of the material body by this quantum. The individuality in a conscious-being is due to the specific cultivation of three properties of matter, the *sata, raja* and *tama*.

In Vedic philosophy the effect of the three properties is seen through the ability of the physical body and through the metaphysical functions that generate thought and exhibit *eekshana*. The *satoguna* represents purity and its cultivation by the conscious-being enhances mind function and cognitive ability. The *rajoguna* represents medium property and its cultivation enhances physical activity and the *tamoguna* represents inertness.

The minutest and innermost physical entity nearest to the soul is the *Buddhi-tatva*, the Intellect-entity. The composition of *Buddhi-tatva* is dominant in *satoguna*; differing amounts of *satoguna* creating different intellects with different elevations of cognitive power. The coarseness increases in all other functions down from *Buddhi-tatva* to *Ahankaar* (Ego-entity), knowledge senses and the karma functions in a living body. The coarseness is indicative of less *satoguna* and more of *rajoguna* or *tamoguna*. The next after *Buddhi-tatva* being the *Ahankaar-tatva,* (Ego-entity), it is said to be dominant in *rajoguna*. A detailed discussion on these entities, based on Saankhya Darshan, will form the subject of another text under the title. 'Vedic *Devas*: A Link between Inanimate and Animate'. Here it would suffice to say that it is the *Ahankaar-tatva* that forms the physical body and keeps it going by creating the desire not to die. Higher level of *rajoguna* creates higher level of ego in the person. It is equivalent to the instinct of survival in modern science.

Higher level of *tamoguna* in a conscious-being is indicative of inertness, non-achieving behaviour and inferior development of intellect. Manusmriti in its 12th chapter has related the three properties to a person.

"*Satvam gyanam tamoagyanam raag-dveshau rajaha smritaha*"

(Manusmriti, 12/10).

This translates into -

"*The knowledge in a person indicates satva, the foolishness tamoguna and attachments to material things and jealousy indicates rajoguna"*.

Manusmriti further relates the three properties to the state of mind of the person. The *satoguna* relates to happiness, the *rajoguna* relates to infelicity and instability of mind and *tamoguna* relates to non-intellectual activity, business in sensuality and materialism. Contrary to this perspective the modern science deals with matter in a separate compartment unattached to the basic nature of the person. The basic nature of the person for modern science relates only to the chemical composition of the physical body and the chemical balance in it.

# Vedic versus Modern Science on Nature

The approach in Vedic science/philosophy for defining Nature may not be the same as in modern science, nevertheless it is thought-provoking and well above the religious dogma. It has many features common with modern science. The most important and unexpected commonality between the two is the corpuscular nature of matter at the basic level of matter's physical composition. The other equally important commonality is the triplet forming a fundamental particle that leads to the formation of matter. The difference between the two systems is that the *satah, rajah* and *tamah* distinction in the Vedic cosmology is an eternal property of matter of the tri-property Nature while in the modern cosmology the quarks appear in the creation phase of the universe after the so-called Inflation Era when Quark-Lepton Era begins at $10^{-32}$ seconds and ends at 10 seconds after the onset of Big Bang. Not clear from the Big Bang Hypothesis is what causes different flavours in quarks and whether quarks existed in matter before they appear in Quark-Lepton Era. When *satah, rajah* and *tamah* are considered as a unit of matter the common term used for them is *aapah*. The similarity here is that a stable nuclear particle made up of three quarks is in the likeness of an *aapah*. The geometric definition of *satah, rajah* or *tamah* is a *paramanu*. Modern science discovered the basic structure of matter by theory and experiment; however, it should be puzzling for a modern physicist as to why and how the Vedic *rishis*, eons ago, arrived at a triplet as matter's most fundamental composition.

In modern physics, Einstein's matter-energy equivalence principle ($E = mc^2$) relates the two forms of matter - mass and energy. The matter in mass m is in coarse form which after transformation into energy E is in subtle form. In this transformation, it is the matter that loses its identity including its identity to exhibit mass. When a hydrogen atom with three quarks in its nucleus made of one proton and one electron orbiting around it is transformed into energy, it transforms into a certain number of energy packets called photons. In modern physics a photon is not known to have any quarks in it or they would add weight to a photon. In the Vedic principle, though untested yet, any transformation of matter that might change the matter's form to equivalent energy would continue to possess either all three types of fundamental particles *sata*, *raja* and *tama* in a given

proportion, or at least possess one of the three particles. Therefore it seems that the *sata*, *raja* and *tama* are at a much subtler level of matter than even quarks and their combinations that create mass in matter. Summarily, based of the Vedic definition of matter, this author's thinking is that a quark is too big to be a fundamental particle – it should be divisible further into smaller particles *named sata, raja* and *tama*.

Vedic thought defining Nature's fine-structure in terms of three fundamental properties was not necessary to promote a religious dogma. The conclusion according to the Vedas that there are three separate fundamental particles/properties at Nature's fundamental level puts Vedic thought straight into the physics arena. Once in physics arena, it would not be scientific on part of a modern physicist to say that the Vedic thought of triplet forming matter is remarkable but it could just be a lucky guess by a Vedic *rishi*. It is not just the idea of a matter triplet discussed here; put forward millennia ago by the Vedic *rishis*, it is the multitudes of thoughts in Vedic science that would put a Vedic reader in amazement.

Ancient *rishis* had certainly learnt to grind substances into fine powders. This however was not sufficient to see three components of matter *sata, raja* and *tama*. They had clear understanding of three phases of water –solid, liquid and vapour. But, that could not have led them to deduce the triplet nature of matter. Therefore, the Vedic *rishis*' suggestion that if one were to go to the final division of a substance it would turn out to be in three distinct quanta, not two not four but three, should remain an intrigue indeed! There is no evidence that the Vedic *rishis* had 'particle smashers' of modern day physics. Did they have a different methodology to determine the fundamental nature of matter? This would remain a puzzle for intellectuals of modern times.

An ordinary answer to such a question is – there must be more ways to understand fundamental nature of Nature. To understand the fundamental structure of matter the subject of particle physics has evolved from its simplicity over a few centuries to experimenting with sophisticated particle smashers. The Vedic *rishis* who drew conclusions to put forward the Vedic concepts for Nature's variants and non-variants had a way to understand nature that we are yet to understand. Until then some of the features of the Vedic science will remain a mystery. A prejudgment that the Vedic ideas could just be imaginations and speculations by the Vedic *rishis* is up for several surprises because this author will present a number of Vedic science

thoughts in this and the forthcoming chapters that are quite intriguing. Some of the examples to substantiate this author's contention related directly to physics where observation, measurements and calculations by ancient Vedic *rishis* led to mind-boggling discoveries with high accuracy, remarkably close to that achieved by modern experimental science.

## *Purush* and *Prakriti* : Togetherness of Creator and Nature

Just as the consciousness and material body pair up to create the reality of a living-being's existence, the Vedic philosophy sees *Purush* and *Prakriti* as a pair for the reality of the creation. It will become clear in the following that in the Vedic cosmology, even though ample recognition is given to the *Purush*, the emphasis is not always to glorify the *Purush* to fulfill the need of a worshiping human-being. When it comes to describing the creation of the universe or the function of a cosmological body itself, a Vedic mantra can be at a high level in poetic expression, yet it delivers contextual knowledge with clarity. If it were only to glorify the Creator to increase faith in a Supreme-being, the mantras that deal with creation of the universe need not have included physics details of creation that would interest only those pursuing knowledge in cosmology. As an example the Veda's assigning a total life-span to the universe of 4.32 BY compared to short life-span of 100 years for humans does not necessarily create greater faith in the Creator. These Veda prescribed numbers may be smaller than those suggested by the contemporary cosmology (13.8 BY); nevertheless, a reference to incredibly large mathematical figures in mantras is primarily for dissemination of cosmological knowledge rather than for creating religious fervor. The mantras furnish the meaning of the term Veda (revealed knowledge) and therefore the Veda mantras should be viewed in that purport. The spirituality in a mantra is for spirituality and the knowledge about the universe and the other physical phenomena revealed in the mantra is for enhancing knowledge which leads to enhancing the intellectual potential. It becomes obvious from the mantras cited in this book that the Vedas have included various necessary steps that are required to build the cosmology scenario for Vedic creation which are not needed for mere worship of the Creator. The Vedic knowledge provides benefits for all, including an atheist.

In the Vedic cosmology scenario, there are no other parallel universes to the one existing. There is no need for many universes when this one is complex enough and large enough to fulfill all purposes.

# (3). The Soul-entity (*Atm-tatva*)

The third eternal Vedic entity named the *Atm-tatva*, expressed as *Atma* or *Atman* is a quantum of consciousness. There are differences and similarities in the two conscious entities, the *Purush* and the *Atmas*. Both have *Eekshana* power to create tangible things with their respective abilities. The differences stem from the singularity of *Purush* versus plurality of the *Atmas*, area of influence, potency, science (knowledge) and many more factors to list just a few here.

To differentiate the *Purush*-entity from an *Atma*-entity, the *Purush* is also addressed as *Param-atma*, meaning the 'primary *atma*' (consciousness). *Atmas* are individualized energy packets independent from each other, all having the virtue of consciousness in them. The term *purush* stands for the all-pervasive virtue of the *Purush* and the term *purush* is also used for a soul because the souls, though discretized, pervade through the universe and available in all places to take birth throughout the universe. An *Atma* is a mass-less non-perishable eternal entity that persists through the creations, indulging with matter by assuming physical body or remaining free from the bondage of matter, depending on its state of spiritual evolution. It is an individualized energy packet like a light-photon with the difference that an *Atma* is with the virtue of consciousness and a light-photon is inert. *Atma* is addressed as the soul or as the spirit in other theistic frameworks of philosophy.

The souls in the creation process serve as part of the 'general-cause'. Striving for knowledge is inherent in a soul. The knowledge in a soul is inversely proportional to the ignorance in it. The enlightenment of a soul gives it freedom and the ignorance becomes a vice, the former taking the soul towards bliss and the latter towards its indulgence with matter (Nature). To gain knowledge of the universe (Nature) and of the Creator, a soul has to indulge with matter by taking a physical body equipped with the knowledge senses and the karma-functions. This is possible when the Nature is in the creation phase with its matter in usable state. The

availability of the creation fulfills the soul's desire to gain knowledge of the pleasurable yet complex inert Nature and of the all-bliss Creator, leading the soul toward higher level of its spiritual evolution. This evolution, not of the physical body but of the soul, leads the soul in its birth sequence to become an enlightened scholarly person (pundit), a scientist or a cosmologist and it enables to gain knowledge of the 'self' and the Creator, leading towards self-realization and bliss. The trend in modern science is to go for cultivation of knowledge and not for self-realization. The Veda mantras advise one to strive for both goals and not to leave the job only half done. Not working for both is said to be the missed-opportunity. In other words emphasis in the mantras is – do satisfy the need of the brain as well as of the spirit (knowledge of matter and consciousness).

Considering that the souls in the universe being infinite in number it is expected in such a Vedic system that souls at different levels of development with free will are going to be at all levels; some at a primitive level and others at human level. Among humans a wide spectrum of levels exists with emphasis ranging from materialism to spirituality. Discovering new knowledge by a pre-enlightened soul in a physical body of a physicist is also expected under this system.

Owing to its minuteness and corpuscular nature the *Atma* is mobile in space when not bound by the material body, latter bound by time and space. In the Vedic system the inert matter acquires the status of animate owing to the presence of *Atma* (consciousness) in it. In Vedic cosmology the presence of this eternal *Atm-tatva,* ubiquitously distributed through the universe is the cause for discretized life-systems on Earth. The Veda mantras reveal that the life-systems are not only on the Earth but they are throughout the universe on the planets of other solar systems. It is this soul-entity that directs the intellect and other faculties of the living body to discover the laws of physics or to create a tangible thing.

In modern cosmology/physics there is no separation between Nature (matter) and consciousness, the *Atm-tatva*. The Vedic system with the existence of the utilizer of this nature, the *Atm-tatva*, discretized in infinite numbers, provides a holistic approach to understand the meaning of the existence of cosmos. The Vedas have provided the connection between the physical world that can be sensed, observed, measured and examined by tools of science and the consciousness; the Creator to create the universe and the *Atm-tatva* as its limited utilizer. In the Vedic Creation Principle, just

as the matter of the universe pre-existed in indefinable matter state of *Asata* to serve as the material-cause, the *Atm-tatva* is a pre-existing eternal entity distributed throughout the universe to serve as the 'general-cause'.

In terms of creativity, the Creator is credited for creating the entire universe and the *Atma*, using its functions, senses and the *eekshana* (desire), creates small things within its limited area of influence. There are several other terms for *atma*. The common ones are *chetan-tatva* (conscious-entity), *jeev-atma*, *jeevatma-tatva* or just *jeev*. The underlying meaning in the term *jeev-atma* is that it is the cause for life in the physical body and its presence in it exhibits action and activity.

A concise definition of the *jeev-atma* (soul) is in a RigVeda mantra (1/164/30):

अनच्छये तुरगातु[1] जीवमेजद्ध्रुवं मध्य आ पस्त्यानाम् ।
जीवो मृतस्य चरति स्वधाभिरमर्त्यो मर्त्येना सयोनि: ॥

(RigVeda, 1/164/30)

**Transliteration:**

"*Anachchhaye turgaatu[1] jeevamejad-dhruvam madhya aa pastyanaam*।

*Jeevo mritasya charati svadhabhiramartyo martyena sayonih*" ।।

**Mantra Translation**:

*"Jeev-named entity is swift[1], immortal and endeavouring. It dwells stably, localized in the house of mortal body and is a repeated visitor of the mortal world".*

(RigVeda, 1/164/30)

These are some of the important characteristics of *jeevatma*. The soul in Vedic philosophy is considered to be the minutest entity such that when in free-state without a physical body, matter does not pose a barrier to its movement. When it is in bound-state in a physical body its movement is limited by the body. The soul with its *eekshana* (will-power) directs the physical body to do actions in its limited sphere. When it is free from the bondage of Nature, its *eekshana* can instantaneously transport it to any point in the universe. This is the meaning of the second word of the mantra,

*turgaatu* (तुरगातु). It is swifter than a photon of light, a photon having the maximum known speed among the physical byproducts of Nature.

The soul is not a byproduct of Nature (matter) but unlike the *Purush*-entity it interacts with matter by taking a physical body to do karma, the desired actions. It is the freedom to do karma that makes the *jeevatma* '*a repeated visitor of the mortal world'*. If the soul has not attained complete freedom from karma and therefore the freedom from the bondage of matter, the law of karma forces the *jeevatma* to begin creating a new physical body in a new mother's womb right after the death of its previous body. The Creator's purpose of creating a universe is for the souls to do karma for improving their status towards freedom from the bondage of matter and therefore by doing further good karma to attain the ultimate eternal bliss. The birth re-birth cycle continues until it becomes completely knowledgeable of itself (self-realization) and of the universe (in a limited sense, not in the omniscient sense). This state of freedom is soul's bliss because it permits a soul to contemplate at will the entire creation and its beauty up close. If such a soul wishes to take birth again it brings the firsthand knowledge of the creation and the Creator and expresses it in the form of mantra formulations.

While the soul is empowered to own the physical body, it provides impetus to the functions of the physical body to gather knowledge with the combination of 13 metaphysical and physical distinct implements (functions), including the 5 well-known knowledge senses. The physical body, especially at the human level, equipped with the highly developed 13 implements called *karans* in Vedic philosophy, provides a special privilege to the soul to do karma (action) with the soul's free-will. A discussion on the 13 *karans* is beyond the scope of this book. However, it is the effect of its actions (karma) that sets the soul's direction towards the next stop after it leaves a body. It is bound by the *ritam* laws of the Creator. Yogiraj Krishn in Bhagvadgita preached to Prince Arjun about soul's (*Atma's*) minuteness and immortality. English translations of only two Bhagvadgita *shlokas* on this subject are presented here:

> *"Neither it* (***Atma***) *is born nor it ever dies. It is not that if it came* (to take birth in a body) *once it will never come back*

*again. It is eternal, unchanging perpetual and ancient. It is not killed by killing the body, it lives on"* (Bhagvadgita, 2/20).

*"No weapon can cut the Atm-tatva, no fire can burn it, water does not wet it and the air does not dry it"* (Bhagvadgita, 2/23).

There is considerable discussion on the *Atm-tatva* throughout the Vedic Literature. The emphasis has been that it is a non-decaying and non-defective consciousness quantum with divine characteristics. This discussion (not included here) includes *Atma*'s location in the living body, its method to control all actions by its living body, what comes with the *Atma* at the time of Creation of the universe, what changes are inherited by it when it leaves one body to take another, what ultimately remains with it when it attains the freedom (salvation) from matter and the cycle of birth and death and so on.

## A Philosophical Perspective:
## Rishi Vaarshganya of Ancient times,
## Aadi Shankaracharya of 500 BCE and
## Prof. Hawking of modern times

In the context of philosophical discussions pertaining to the eternal entities and the creation of the universe, several references from the ancient Vedic and non-Vedic philosophies are found in the post-Vedic literature. The non-Vedic philosophies have been closer to atheism and pantheism. The whole universe for an atheist is inert Nature which maneuvers itself under its own laws to create this vast and diverse universe. For a pantheist the whole universe is out of a single entity, the Nature, or out of a single conscious-being Creator. In ancient India there have been a few thinkers and philosopher, who subscribed to such non-Vedic philosophies. The freedom of thought and speech has always been a progressive feature of the Vedic religion and philosophy. To name one here, a philosopher non-concurrent with the Vedic philosophy, during the ancient Vedic period, was Rishi Vaarshganya. Owing to his scholarship he is addressed respectfully as a *rishi*. He hypothesized that the inert Nature alone was sufficient and responsible to create the universe and the existence of God was not needed (discussion in "The Vedant Darshan Ka Itihas (1991)" by Acharya Udayaveer Shastri)

In the Vedic cosmology arena it would not come as a surprise when the renowned cosmologist Stephen Hawking in his recent book entitled "The Grand Design" declared that God was not needed to create a universe and that the universe would create itself out of nothing and sustain itself owing to gravitation (this text was written before Professor Hawking passed away). Hawking being a mathematician/physicist, his declaration is based on the elaborate mathematical hypothesis. Whichever way one puts it, such an argument ultimately precipitates into saying that the inert Nature (matter) by itself creates the universe. This was also said by the ancient *rishi* Vaarshganya eons ago. The logic behind the argument is that the gravitation in matter is due to mass in it and mass in matter is due to the existence of matter, and all of this is out of 'nothing' - the other name of which being the "space-time singularity" of modern Big Bang Hypothesis. Rishi Vaarshganya in ancient times and Hawking and others in modern times do need Nature to create the universe.

The Advaita Philosophy (non-duality) of Aadi Shankaracharya (509 BCE - 477 BCE) was alluded to in Chapter 3 and 4 which stipulates that everything

in the universe - all souls, all cosmos and the entire matter of the universe, is nothing but God. In this philosophy the difference between *Purush* and *Prakriti* or *Purush* and *Atma* is non-existence. God creates the universe out of Himself and the observable universe is not a real entity but a mere illusion (*maaya*). That everything in the universe is the Creator is similar to the philosophy of pantheism where everything is Nature. A soul-entity in Rishi Kapil's Saankhya Sutra and Rishi Kanaad's Vaisheshik Sutra is an individual and independent entity with consciousness as one of its virtues. It is different from the other souls and different from the Creator of the universe. Even the Vedanta Sutra (1/2/11) of Rishi Vedvyas has stated that the God and the soul are two different entities.

In the Saankhya Darshan *sutra* (1/61) presented earlier under "The *Purush-tatva*", Rishi Kapil states that God is the controller of Nature. In the successive *sutra* he also states that in specific actions the *jeevs* (souls) are also the controllers:

विशेषकार्येष्वपि जीवानाम् । (Saankhya, 1/62)
(Visheshkaaryeshvapi jeevaanaam)

"Souls are also the controllers in specific ations"
(Saankhya, 1/62).

The word *jeevaanaam* in this sutra represents the plural of the word *jeev*, indicating plurality of *jeevs* (souls). The singularity of God and plurality of souls in Saankhya also represents the clear distinction between the two separate conscious entities. The soul in the Vedas, Saankhya Darshan and other Vedic Darshans is an individual entity responsible for its own actions and is a controller of its own area of influence to a limited degree. This is why *Atm-tatva* (*Jeevatma-tatva* or soul-entity) was expressed as being a part of a discretized field of consciousness embedded within a single conterminous field of consciousness, the *Purush*. In the Vedic philosophy there is a clear separation between the components of the Vedic-trinity (*trishtup*): God-Nature-Souls.

As mentioned before, owing to the ubiquity of *Atmas* (souls) through the universe they are also addressed as *purush*. Based on observation and reason, Rishi Kapil in his Saankhya Darshan emphasized the plurality of the *purush* (souls),

जन्मादिव्यवस्थात: पुरुषबहुत्वम् ।

("*Janmadi-vyavasthaateh purush-bahutvama*" ) (Saankhya, 1/114)

**Translation:** *"The system of births and rebirths reveals that the souls are many"*

(Saankhya, 1/114).

This principle of Saankhya Philosophy is supported by Rishi Kanaad in his Vaisheshik *sutras*, 3/2/20, 21).

Aadi Shankaracharya's Advait Philosophy that everything is God is based on his interpretation of the last Darshan, Brahm Sutra authored by Rishi Vedvyas close to historic milestone at 3140 BCE. The fact is that the Vedanta Sutra does not support the Advait Philosophy. Just one of several *sutras* is presented from the Vedanta Sutra,

गुहां प्रविष्टावात्मानौ हि तद्दर्शनात् ।

(*Guhaam pravishtaavattmaanau hi taddarshnaat*) ( Brahm Sutra, 1/2/11)

**Word Translation:**

गुहां (*guhaam*) = in the cavity (of mind), प्रविष्टौ (*pravishtau*)= (two entities) entered, आत्मानौ (*atmanau*) = two *atmas* (*two souls*), हि (*hi*) = with certainty, तद्-दर्शनात् (*tad-darshanaat*) = due to their revelation there.

**Sutra Translation:**

*"In the cavity* (of mind) *reside two souls* (*the Atma* and *the Parmatma*), *where both are revealed with certainty"*.

(Brahm Sutra, 1/2/11)

In Vedic thought the place of the soul (*Atma*) in the living body is in the cavity of the mind. In context with the locale of the soul in the living body the Veda, Upanishads, Darshans and the rest of the Vedic literature have all stipulated that the soul resides in the interior of person's head in a specific small locale addressed as गुहा (*guhaa*) which means a cave (cavity). This cavity is said to be the size of the tip of the thumb. Depending on the context it has also been addressed with other terms such as *gyan-granthi* (knowledge-gland), *antehakaran* (interior mind function) and so on. In the yoga practice and

meditation the place for invocation of God and self realization is also the mind.

The singular term for *Atma* according to Sanskrit grammar is आत्मा (*atma*), its dual-plural is आत्मानौ (*atma-nau*) and its plural is आत्मानाम् (*atma-naam*). Addressing the presence of the souls in the cavity, Rishi Vedvyas's usage of the word is unambiguously the आत्मानौ (*atmanau*) for dual-plural. This tells us that there are two separate *Atmas* (souls) in the single cavity of the mind. Since the God is thought to be all-pervading it would be found in all cavities, Rishi Vedvyas expresses in his *sutra* with "certainty" the presence of the *Atma* and *Paramatma* (the Creator) in a single locale. The *sutra* by itself suggests that the God and the soul reside in the cavity of mind *where both are revealed with certainty*. The two entities in one place are possible when they are two different entities. In the Brahm Sutra the *Purush* and *Atma* are two distinct entities and are also eternal. Therefore, the *Advaita* Philosophy does not change the Vedic premise on the list of eternal entities.

In the context of the creation of the universe, whether it is the ancient atheistic philosophy of Rishi Vaarshganya wherein everything is matter, or Shankaracharya's theistic philosophy wherein everything is God, or it is the modern atheistic philosophy wherein matter and its gravitation serve all three 'causes' for the birth of the universe, as advocated by Professor Stephen Hawking and others, they all in fact are saying the same thing with differing terminology. This author has put Hawking's theory into the category of philosophy because Hawking has hypothesized the creation of the universe based on his mathematical equations and has talked about the uselessness of God in the process of creation without having at least a hypothetical God in his equations. When one talks about Nature and its gravitation as the creator of the universe without proving his deduction in a physics laboratory, one is a philosopher first and a mathematician and a physicist next. In these non-Vedic philosophies, the material-cause is its own efficient-cause and vice-versa, call it Nature, God or gravitation. Several other non-Vedic atheistic philosophies have also emerged from the Indian soil such as the Buddhism, Jainism and Chaarwak (materialism).

## The Vedic Trinity

## (Vedic *Trishtup*)

The Vedic Religion has a trinity which is addressed as the *trishtup*, meaning - the three together. This *trishtup* is formed of the three entities defined above - *Purush, Prakriti* and *Atmas*. Similar to the Vedic trinity is the trinity in Christianity formed of Father, Son and the Holy Spirit - all three spiritual entities. The origin of the Sanskrit term *trishtup* is in the far antiquity of the Vedic Literature. The Vedic trinity is formed by two spiritual entities and one inert entity – the *Prakriti* Nature). There is a causal relationship between components of the Vedic *trishtup*: *Purush* the efficient-cause of the universe, *Prakriti* the 'material-cause' of the universe and *Atmas* the 'general-cause' of the universe.

The causal relationship of the three causes extends to the cause-effect rule in the creation and it becomes a tool for enhancing knowledge in both realms of the creation, animate and inanimate. Kanaad Rishi in Vaisheshik *sutra* (2/1/24) stated: "*It is observed that the properties in the effect are accordant of the cause*". The implication of this statement is that the properties in matter are those inherited from the original material-cause, the Nature. In the Vedic creation and therefore in the Vedic *trishtup*, the three entities (*Purush*, *Prakriti* and *Atmas*) play their own roles but do not convert into each other.

The Vedic *trishtup* is very beautifully depicted by the RigVeda mantra (1/164/20) in a poetic adornment called रूपकालङ्कार (*rupakaalankaar)* wherein the subject matter is expressed in an allegory of two birds with beautiful wings perched on a tree, one being the *atma* (the soul) and the other being the *paramatma* (Supreme Being) and the tree being the creation (Nature). The mantra translation is:

> "*There are two conscious entities* (soul and the Supreme Being) *possessing divine qualities, coexist in the same creation* (the Nature) *as intimate friends in companionship. One of them enjoys the fruit of his action (indulges) and the other simply observes from all sides without indulgence.*" (RigVeda, 1/164/20).

# (4) Time-Entity
## *(Kaalah-Tatva)*

The fourth eternal entity of the Vedas is Time. Vedic term for Time-entity is *Kaalah-tatva* or *Kaal*. First part of this section deals with the definition of Time and the second part deals with measures of Time. The Vedic definition of an abstract entity such as Time reveals the depth of thought and grasp of understanding by the Vedic *rishis*. The concept of Time used in modern cosmology is millennia old with its origin in the Vedas. The measurement of Time with well thought-out time-scales reflects the ability of the Aryans and the Aryan society in experimentation and application. The elaborate time-scales of the Aryans relate to practical astronomy encompassing time scales of billion-years in *yuga* units down to mind-boggling and experimentally derived *nimesh* time unit in millisecond. An AtharvaVeda mantra delineates the complex concept of time:

कालो ह भूतं भव्यं च पुत्रो अजनयत् पुरा ।
कालादृचः समभवन् यजुः कालादजायत ॥
(AtharvaVeda, 19/54/3)

**Transliteration***:*

*"Kaalo ha bhootam bhavyam cha putro ajanyat pura.* Kaaladrichaha sambhavan yajuh kaalaadjaayat".

**Word Translation:**

काल: (kaalah) = the Time-entity , ह (*ha*)= is itself, भूतं (bhootam) = past, भव्यं (bhavyam) = future, च (cha) = and, पुत्र: (putrah) = son, अजनयत् (*ajanyat*) = given birth to, पुरा (pura) = the one born before (father)।
कालात् (*kaalaat*) = from Time, ऋच: (richah) = knowledge bestowing mantras,

सम अभवन् (*sam abhavan*) = are created ,यजु: (yajuh) = YajurVeda (or knowledge of right actions), कालात् (*kaalat*) = from Time, अजायत (ajaayat) = is born of ॥

**Mantra Translation**:

> *"Kaal the son is its own father* (the past) *and will be born as its own son* (the future). *Richas, the knowledge bestowing mantras, are born out of Kaal and Yaju the knowledge of righteous actions is born out of Kaal"*. (AtharvaVeda. 19/54/3).

The *devata* (subject) of this *sukta* is *Kaalah-tatva*, the Time-entity. The first part of the mantra was also presented in Chapter 1 of this book. The continuity in Time-entity's flow could not be expressed in a better way than this riddle! In real life a father gives birth to a son and the father and the son represent respectively the past and the present. Even though their life-spans generally overlap on the timeline, the irreversible Time puts them on their respective time segments. When it comes to Time-entity itself, the past is created only because the present is born. There cannot be an overlap between the past and the present. Therefore, the *putro* (the son) of Time gives birth to its own *pura* (father) because a past is not born without the present being born.

The mantra completes the riddle in its first line by stating that it is the Time-entity which itself is born as its own son the *bhavyam* (future). The next mantra (19/53/4) in the same sukta, presented below, also repeats the same theme that Time is its own father and its own son. There the mantra explicitly uses the terms, पिता (*pita*) and पुत्र (*putra*) respectively for father the past and future the son. Therefore, is there a better way of defining Time than it being its own father and its own son? The mantra also reveals the thought process of the *rishi* to come up with a unique way of relating the past, present and the future of the Time-entity. This is his way of defining a real continuum.

The second line of the above mantra states that the *richas* are also the result of time. *Richas* are the mantra compositions revealing hidden knowledge of the creation and all subjects within. They could not have come about without the existence of Time. After knowledge comes action. Therefore the mantra gives special reference to the word *Yajuh* that encompasses 'knowledge of all right karma'. Implicit here is that YajurVeda (second Veda), which is the book of knowledge for right and righteous actions, has also come into being because the existence of Time. Therefore, the emphasis in the AtharvaVeda

mantra is that one needs the existence of the Time-entity to acquire the knowledge of the past, present and the future.

Some well-known cosmologists like Roger Penrose have suggested that the mind-entity that perceives time should also be studied and understood before one can know what Time is. Time in Big Bang cosmology is used but not understood. It is thought to be a real entitity which takes birth at t = 0 sec, about 13.8 BY ago and will continue to grow bit by bit in future. An entity that has a begining can grow only bit by bit and not knowing its nature and the mechanism for its growth one could not say that it could not come to an end. If it does not come to an end it will grow to infinity and would affect the functioning of the universe in some unknown way. The bit by bit growth means the entity is discontinuous at its fine structure. Different bits of such an entity cannot have togetherness in them forever; one part may affect the universe one way and the other part may affect in another way leading to chaos.

*Kaal* (Time-entity) in the Vedas is an all-pervasive eternal entity covering the entire creation and flowing irreversibly forward nonstop as a continuum in three dimensions. *Kaal* in the Vedas is a real entity. The Vedic argument for the pre-existence of Time from even before the present creation is straightforward. The Vedic creation being a recurring phenomenon, with matter changing its state cyclically from indefinable *Asata*-state to definable *Sata*-state and back again needs the Time to be in existence in both states. Of course a state of matter, *Asata* or *Sata*, needs a container wherein to exist. This container of matter is the Space-entity. Because the two differing states of matter (*Asata* or *Sata*) occupy differing Space, the Space-entity has to be a flexible and non-snapping. Let us assume that the matter is in the *Asata*-state of dissolution confined in the diminutive Space (*tuchchhayen* of RigVeda, 10/129/3) and there was no Time-entity. Because all events take place in Time and if Time is not there the matter will remain in diminutive dissolved state of *Asata* or in whatever state it is. In other words the matter of the universe without Time will remain in a status quo. Therefore both, Time and Space, are needed to pre-exist for the creation of the universe. The eternity of Time-entity in the Vedic creation is also a prerequisite in the 'Cyclic Universe Theory" proposed by Steinhardt and Turok (Science, May 5, 2006). The basic premise of this theory is the same as in the Vedic creation that the universe is in a perennial cycle of creation and dissolution.

The concept of the Time and the Space as entities is not an invention of contemporary cosmologists. Considering that the Time and Space are defined

in the mantra formulations wherein their properties are revealed, the concept of Time and Space is as old as the Vedas. The Vedic *rishis* had recognised Time and Space as an entity in the process of creation of the universe and captured it into mantra formulations well before the birth of "space-time continuum" in modern cosmology.

In addition to numerous Veda mantra references on *Kaal*, the AtharvaVeda has devoted two successive *suktas* 53 and 54 of its 19th Chapter with a total of 15 mantras stating the characteristics of Time and its association with other entities. For the sake of brevity, direct English translations of some mantras, without their Sanskrit text and word-for-word translation are presented in the following. Interpretations of the mantras are presented where necessary. In modern literature one comes across expressions and similes for Time, such as the 'arrow of time' and 'like the flow of a river'. In this respect the Vedas have not been abaft. Some of the ancient adjectives for Time that have appeared in the mantras will be pointed out. The emboldened Vedic terms in mantra translations are interpreted further because these terms establish the relationship of Time with the hidden thoughts in the mantra.

## Mantras from *Kaal Suktas* (53, 54) of AtharvaVeda's 19th Chapter

**(AtharvaVeda mantra 19/53/1)**

> "*Kaal is like the potent un-ageing horse in perpetual motion (flow) on which ride the* ***sapt-rashmi*** (seven-colour-rays) *and the* ***sahashra-aaksha*** (thousand-eyed) *Sun. On it ride the knowledgeable and intellectuals. All* ***bhuvanani*** (created celestial bodies) *ride on its* ***chakra*** (wheel or cyclic order)".

This mantra lists time-dependent physical phenomena with several adjectives associated with Time. One unique adjective for the Time-entity is the '*potent un-ageing horse*'. A horse symbolizes power and motion. The expression that Time is the *potent un-ageing horse* means that this entity is unstoppable and eternal which continues on its eternal journey. A familiar fact about this entity is that when the 'time comes', the event that is to take place will take place. Additionally, this mantra is a concentrate of thoughts

expressed explicitly and implicitly on time-dependent physical phenomena. These thoughts are remarkably adorned by compact Vedic Sanskrit terminology. The ***chakra*** of Time in the mantra means the cycles and the periods observed all through Nature. The specific reference to Sun in the mantra is important. The Sun relates to all ***chakra*** in the solar system including the ***chakra*** of day-night and year on the Earth. The Sun's reference also includes its rays which are a time-dependent dynamic phenomenon, solar rays reaching the Earth in 8 minutes. The mantra puts an explicit designation of ***sapt-rashmi*** on the rays of the Sun which translates into 'seven-rays of the Sun', the major seven colours in the solar spectrum. Not only the physical optics is a subject here that the *rishi* of the mantra recognizes but he is pointing to the fact that solar rays are a time dependent dynamic phenomenon.

Humans have been seeing the multi-coloured rainbow since they have seen the Sun. A rainbow remained a mere abstract painting far away on the canvas of the sky, out of reach. However, the assignation of number 7 to the count of colours in the sunlight, as in the above mantra and the rainbow as '*Indra Dhanush*' (Sun's bow) in other mantras, is an example of deductive optics by the Vedic *rishis*. The Vedas had recognised that the colours seen on the screen of the sky were in fact those in the rays of the Sun. The reference of ***sapt-rashmi*** (seven-rays) for the sunlight has appeared in the Veda mantras many times (e.g. RigVeda, 1/50/8, 1/164/2, AtharvaVeda, 7/107/1, 9/9/2,..…). More discussion on the solar rays is in the section on Sun in Chapter 8. Even the term *mani,* which means a crystal dispersing solar rays into colours, has appeared with reference to the solar rays. The modern optics began with the ***sapt-rashmi*** designation of the Sun by the Vedas. Sir **Isaac Newton** (1642-1727) is credited to have assigned 7 colours to sunlight. Obviously he was not the first to do so.

The other adjective for the Sun in the mantra is the ***sahashra-aaksha*** which translates into – *the Sun with thousands of eyes*. Eyes are to see objects. Most living beings with just the two eyes see in a considerably wide field of view without turning their heads. If humans were blessed with a thousand eyes they would see all around them at the same time. What the eyes receive from the objects that they see is the solar spectrum reflected from the object. Therefore, the metaphor of Sun having thousands of eyes means that the Sun illuminates all objects all around it. The Sun in other Vedic mantras is the illuminator of all ***bhuvanani*** around it. The term ***bhuvanani,*** plural of ***bhuvan***, means '*astronomical objects of terrestrial nature*'. Dynamics being a feature of all time-dependent phenomena in nature, implicit in the mantra is the time-

dependent relationship between the *Kaal* (Time) and the Sun's rays and the Sun itself. A basic deduction from the mantra is that the rays of light take time to go from one point to the other.

A powerful horse is generally associated with a chariot with ***chakras*** (wheels) which continue to turn in their own cycles while the horse ahead of them keeps moving in one direction. Therefore the horse-simile for Time is drawn to show its continuity within which many time-cycles associated with diverse cosmological bodies and phenomena persist. Humans move faster when they ride a horse. The ***sapt-rashmi*** of the Sun riding on the horse of Time implies that the Time moves even faster than the solar rays.

The second line of the mantra stipulates that, in addition to physical systems where time is of the essence, even the intellectuals and the wise cannot function without the sense of time. Time is of essence for an intellectual idea to happen. The knowledge of time itself is put on a high pedestal by the Vedas. The term for the scholar of time-science is '*maatali*'. A cosmologist of today is a *maatali* of the Vedas.

**(AtharvaVeda, 19/53/2)**

> *"The Kaal rotates the **sapt-chakran*** (the system of seven wheels) *around their respective seven **naabhi**s* (foci/centres) *with just one **amritam-aksha*** (immortal axle). *The Kaal with certainty is the **first deva** that reveals all objects of creation"*.

It was the time-dependent *sapta-rashmi* (seven rays) of the Sun in the first mantra. In this mantra the Time is correlated with a mysterious *sapta-chakran*, a system with seven cycles, each cycle being around its own focal point (***naabhi***) yet the system has only one immortal-axis (***amritam-aksha***). Since the subject relates to wheels and cycles, the axis in the mantra is the axis of rotation. The condition of a single axis serving all seven wheels is fulfilled only when each wheel is confined into the next without their circumferences crossing each other. This is similar to the orbits of the planets around a common axis, the Sun. Usually an axle of a wheel wears out with time. But the axle that the mantra is talking about is such that it never wears out - thus maintaining its immortality. All substantive objects change with time and so should the common axis of the seven wheels mentioned in the mantra. But the mantra states that this particular axis is not a transient axis and it does not wear out with time and therefore the adjective of ***amritam-aksha*** for the axle. This

means that this un-wearing-down axis is the axis of rotation and not a substantive physical axle.

The major terminology of the mantra being in the realm of mechanics with reference to astronomical bodies, it is not far from the reality to say that the mantra is alluding to the solar system with seven observed planets forming the ***sapta-chakran*** with one common ***aksha*** (axis) of rotation through the Sun, an axis that does not show any sign of wearing out. Several more mantras in Chapter 11 in Volume 2 also support the astronomy nature of this deduction.

The Time in this mantra is addressed as the ***first deva*** because it exists before the beginning of the creation when the other *devas* are created. The *deva* or *devata* systems in the Vedic cosmology are said to be the first progeny, the physical systems of Nature that enable the creation and its sustenance till the end of creation. Time in this mantra being adorned by the adjective of '*the first deva*' could also be translated as '*the deva before all devas were created*'. Among a total of 33 inert *devas* in the Vedic creation are the first seven *devas* known as the 7 *Aditi-putraha*, the Nature's progeny (discussed in Chapter 8). The Time therefore is one of the important entities in the Vedic creation.

**(AtharvaVeda, 19/53/3)**

> "*On Kaal is sustained the brimful-kumbha* (pitcher), *the kumbha that we of the present observe in numerous ways. Kaal continues to move ahead of all substances of creation. It is this Kaal that is understood and deduced by intellectuals from the understanding of param-vyom* (vast space)".

A *kumbha* is the spheroidal earthen-pitcher used for bring water home from a well which generally is some distance outside the village. The career carries the brimful-pitcher balanced on the head. The relationship of a brimful-pitcher of water and the Time is quite mysterious. *Kumbha* has been the main object in Vedic philosophy for exemplification of the cause-and-effect where the clay of the pitcher is the *upadaan-kaaran* (material-cause) which is Nature and the pot-maker is the *nimitta-kaaran* (efficient-cause) the Creator. In this mantra the *kumbha* is the Nature in its definable form.

The mantra expresses that *we of the present observe Nature in numerous ways*. A *kumbha* faraway looks small which continues to grow as the pitcher's carrier approaches nearer and nearer. This approach is time depended. The mantra through the simile of Nature as the brimful-pitcher delineates an observational scenario where the pitcher is perceived differently from different

distances and at different times. Like a *kumbha,* the objects in *param-vyom* (vast Space) are seen in a relative perspective. It also suggests that to understand Time's nature one has to understand the objects of Nature far and near and within the perspective of Time. The mantra further propounds that to learn about Time the intellectuals extend their observation of Nature from close quarters to *param-vyom*, the farthest of the deep-space. The pairing of Space and Time is the obvious thought in this mantra.

Although the mantra does not give us hard numbers on observations of the vast-space (*param-vyom*) that could be used to deduce the specific nature of Time, it does tickle one's imagination to think of the principle of relative position in space and time of the moving objects. We may not be aware of it but we follow this principle in daily life. The time of creation in billions of years was arrived at by Vedic *rishis* inspired by similar mantras when they observed the *param-vyom* which embedded the system of *sapta-chakran* (seven-wheeled system) of planetary motion with the Sun being their single axis (*aksha*). It is the observation of distant objects in motion that tell us more about time and space. Let us take up a contemporary example related to studying substances in Space (*param-vyom*).

Space stretches from the Earth to the farthest galaxy. Beginning with the Earth, a study of the oldest rocks on Earth by scientists of the University of McGill in Montreal (in 2008 CE) concluded that the Earth is at least 4.28 BY old. Canadian geologists also found (March 1, 2017) rocks with microbes petrified in them about 4 BY ago. The age of the Earth is estimated to be 4.6 BY. Therefore, the life evidently began on Earth within 600 MY of the formation of the solar system including the Earth. Another example of scholarly studying substances and placing time stamp on them is extra-terrestrial object, a meteor. The age estimate of a meteor yields 4.6 BY, which by reduction is the age assigned to the entire solar system. Red-shift in the spectrum of light rays (*sapt-rashmi*) coming from the edge of the *param-vyom* tell us that the universe is 13.8 BY old and expanding. Thus the observation and knowledge of objects of *param-vyom* teaches us about the nature of Time. By definition the term *param-vyom* is the highest or deepest of space that according to Veda "*preserves all that exists there*".

**(AtharvaVeda, 19/53/4)**

"*It is the one (Kaal) that has nourished the cosmos, it is the one that has completely and uniformly encompassed the cosmos. While being the* पिता (*pita* = father) *of the cosmos it has provided*

*continuity by being the* पुत्र (*putra*) the *son of itself. In this creation none is older than Kaal"*.

Notice the riddle of Time being the father and the son is repeated in this mantra where the continuity of Time is of essence. *In this creation none is older than Kaal* makes this entity pre-existing the creation.

**(AtharvaVeda, 19/53/5)**

*"Kaal has created the dyu (illuminated region around the Sun) and the Earth. In Kaal is its past, with certitude in Kaal is cast its future"*.

**(AtharvaVeda, 19/53/6)**

*"Within Kaal the matter comes into being, within Kaal the Sun exists to give off heat energy. All cosmos are in Kaal and in Kaal the eye sees variously"*.

These mantras are self-explanatory. Full translations are not provided for the remaining mantras in the two *Kaal suktas* of AtharvaVeda, only the essence is presented. These mantras state the importance of measuring *kaal* (time) from the *Kaal*-entity. They state the relation of *Kaal* to other phenomena and systems of creation that relate to the physical as well as metaphysical creation.

**(AtharvaVeda, 19/53/7-10)**

*"Kaal encompasses all entities of the creation that relate to forces of Nature that sustain the living system in the creation, provides opportunity for karma, enables the knowledge of Veda and the nomenclature of all substances of creation therein. Kaal is the revealer of the creation and the Brahmn the Creator. Kaal has fathered all celestial praja, the heavenly population of this creation, and it is the nurturer and binder of all creation. In it are stably sustained all cosmos"*.

**(AtharvaVeda, 19/54/1, 2, 4, 5)**

*"Kaal is the measure of the Kaal-entity* (Time-entity*), the time, which gives us knowledge of all. In Kaal are born the disha (directions). The Sun rises in it and sets in it punah* (again and again). *All motions exist within kaal including movement of the wind. The Prithvi in it has become mahi* (the Earth has grown colossal) *and the dyu* (the illumine space, the abode of Sun) *has been placed there. All lokaha* (terrestrial planets) *flying in space and all that non-decaying stability of the whole cosmos is due to Kaal-entity"*.

Lastly, it states that,

…ब्रह्मणा कालः स ईयते परमो नु देवः ॥

(AtharvaVeda, 19/54/5)

( "*Brahmna kaalah sa eeyate parmo nu devah*").

**This translates into:**

*"…Biggest of all devas, the Kaal, coexists with Brahmn the Creator and continues to move fast"* (AtharvaVeda, 19/54/5)

This mantra is explicit in defining the *Kaal-tatva* (Time-entity) to be creation's eternal entity. Coexistence of *Kaal* with the eternal entity *Brahmn* the Creator and the efficient-cause of the universe, makes it automatically an eternal entity. The additional knowledge in the last part of the mantra is that the *Brahmn* and the *Kaal* are two distinct entities that coexist in this creation. The *Brahmn*-entity is not created and therefore Time-entity in Vedic thinking is not created at any particular event like t = 0 sec of modern Big Bang hypothesis. This limited discussion shows that the Veda has gone deeper in defining and describing the nature and properties of the Time-entity than modern science has.

Time and space in Theory of Relativity are knotted together as space-time continuity. As this author has emphasized before, none of these entities could be measured absolutely; only their differences are measured. Of the five eternal entities being discussed here, two being consciousness do not permit their quantitative measurement. The other three permit limited access for their measurement. Nature allows us to measure mass in matter but the Time does not allow us to measure its 'present' because the present is infinitely minute.

But it allows us to measure its linear span in its past. The Space allows us to measure it in three dimensions. All these measurements together help to further our knowledge within our reference frame which to some degree is extendable to the reference frame of the universe. The recognition of the importance of measurement of these entities has been an ancient practice. Before presenting the Time and Space measurement scales of the Aryans let us look at the fundamentals of Aryans' approach to complex concepts.

## Measurement (*Maatra*) leads to Enhancement of Knowledge

Aryans have looked at the Time-entity in its totality. A unique, remarkable and insightful evidence of this is in the 10th *shloka* of Surya Siddhant (The Sun Principle). A treatise on indigenous practical astronomy, "Surya Siddhant", was referred to several times in Chapters 1 and 3. Recalling this shloka from Chapter 1, one finds that the Aryans have viewed the Time-entity for what it really is – unfathomably eternal entity and inconceivably minute as well as measurable to some extent in between the two extremes. Surprisingly, the terminology in the *shloka* is as if it has been drawn from a modern physics text book. The *shloka* translation is repeated in the following:

> "*Time is in two classes. First, the cause of creation and dissolution* (being eternal) *is unknowable and the second is knowable. The second-class is in two categories – one is moort* (comprehensible and measurable) *and the other is sookshma* (immeasurably minute)." (Surya Siddhant, 1/10).

The depth of thought in this shloka on the nature of Time is obvious. It is the comprehensible and measurable *moort* time that is the subject of this section. When a measurable entity or a phenomenon is adroitly defined, as Time-entity in the AtharvaVeda mantras and in the *shloka* of Surya Siddhant, its measurement is inevitable by those who have grasped its reality. Developing the measurement methodology for it need not take millennia wait for the 19th century cultural renaissance. The time measurement and the time division of the Aryans discussed below would make it obvious that the Aryans had already achieved a high level of success in time measurement and in devising time-scales for advancing the knowledge for their future generations.

One method for advancing the knowledge is to devise a measurement scale for measuring an entity. Once a stable measurement scale is worked out, it continues through future generations and sometimes through future

civilizations. For example the scientists of the present civilization have benefited from the measurement scales invented in the past civilizations; popular ones being hour-minute-second for time, inches-foot-yard-mile (British) or centimeter-meter-kilometer (metric system) for distance and ounce-pound-ton (British) or gram-kilogram-quintal (metric system) for mass. With the progress in science it became necessary to extend both sides of the preexisting scales and add to the roster some new units and scales of distance, force, energy, electricity, magnetism and so on.

No measurement of any entity is in isolation. When an entity or a part of it is measured the other entities serve as a 'general cause'. Therefore, a simple dictum in measurement could safely be postulated by this author as:

*"No measurement of Space, Time or Matter is independent of the other two"*

When a cube of matter is measured in its length, width and thickness the space gets measured and it is not independent of 'time'. When a person makes a time measurement it has a beginning of time and the end. During this time the person has aged changing the matter in his body which also changes the space occupied by the person, be it a few cells. Therefore, what is being measured and what else gets measured needs to be recognized. In this recognition if one is measuring an entity the person must know what are the other associated entities taking part in this measurement and recognize where the entity belongs - in time, in space or in matter? To resolve this philosophical imperative the Vedic philosophers have attempted to put a handle on it. This handle is termed as the '*linga*' or '*lingam*' of the entity. It was mentioned in Chapter 1 and in the Vaisheshik *sutra* (4/1/2) presented in this chapter that the word *linga* stands for the 'defining symbol' or the 'defining property' of the entity/phenomenon. Any measurement of an entity required a pre-recognition of the *linga* of that entity.

Kanaad Rishi in his Vaisheshik Darshan has examined phenomena, substances and entities from this perspective and laid down the principles (*sutras*) for future knowledge enhancement. For the Time-entity he states (Vaisheshik, 1/2/6):

अपरस्मिन्नपरं युजपच्चिर क्षिप्रमिति काललिङ्गानि ।

(Vaisheshik Darshan, 1/2/6)(*Aparsminnparam yujpachchir kshipramiti Kaal-lingaani*)

**Translation:**

*"The knowledge of younger, older, simultaneity, later, sooner are the lingas of Kaal (Time)"* (Vaisheshik Darshana, 1/2/6).

For Rishi Kanaad to have put together in one *sutra* all *lingas* of Time is uniquely remarkable. To the best of this author's understanding, not one factor can be added to or subtracted from his list. These *lingas* of the Time-entity are self-explanatory. A time related phenomenon would have at least one or more of these *lingas* present in it, differentiating the measure of time from the measure of space or matter.

Expressing a substance in terms of a unit of measurement is inherent in humans. In Vedic practice the generic term for a measurement unit is 'maatra', amazingly close in sound to the word 'meter'. The maatra or the unit of measurement in the Vedic civilization is as old as the Vedic civilization itself. Considering the antiquity of the Vedas, the range of scales for measuring time, space and matter is surprisingly quite extensive on both, the lower as well as on the higher ends of the scale. The Vedic counting from zero upwards is summarized in Table 5.2.

These units, with their original Sanskrit nomenclature, as it appears in the Vedas and the Vedic Literature, are listed in the second column. This author has added in the first column of the tale the numerals in the standard form with zeros after 1 or in the scientific notation with the number of zeros expressed as the exponent of 10. In the third column are added the terms in the common usage in English.

A YajurVeda mantra (17/2) was cited in Chapter 1 which teaches the counting of large numbers in metric system from 'one' to '*paraardh*' ($10^{18}$) (with 18 zeros after 1) in 19 steps. After listing these steps of the metric system of counting, the long *chhanda* (mantra) of YajurVeda terminates with an interesting conclusion in its second part. It states –

"…*When you think of counting bricks, think of the vast Space and those worlds out there that are observable* (धेनव: लोके = *dhenavah loke*)[1] *and non-observable* (धेनव: अमुष्मिन् = *dhenavah amushmin*) [2] *to which also these numbers apply, where you may be in rebirth* (अमुत्र = *amutra*) [3]".

An AtharvaVeda mantra (10/8/24) in a different context also gives a count of 100 (*shatam*), 1,000 (*sahasram*), 10,000 (*ayutam*) and 100,000,000

(*nyarbudam*).

The remnants of Vedic education system still existed in the county-side of India when this author started schooling. In the elementary classes, right after learning the numerals the guru taught the multiplication-tables up to 40 and additionally taught the times-tables for quarter, half, three-quarters, one-and-a-quarter and so on till four-and-a-half. Then the guru taught the large range of numbers and the nomenclature of units to go with it right up to $10^{19}$ (19 zeros after 1 which is ten-billion-billion, one step more than in the YajurVeda mantra) which is still in this author's memory for recital in the correct order.

**Table 5.2: Numerical counting system of the Aryans**

| No. | Vedic Nomenclature | Western Nom. | No. | Vedic Nom. | Western Nom. |
|---|---|---|---|---|---|
| 0 | *shoonya* | zero | $10^9$ | *arbudam* | billion |
| 1 | *Ekam (ikaai)* | unity | $10^{10}$ | *dash-arbudam* | ten billion |
| 10 | *Dasham* | ten | $10^{11}$ | *kharab* | one hundred billion |
| 100 | *Shatam* | one-hundred | $10^{12}$ | *dash-kharab* | trillion |
| 1000 | *Sahasram* | thousand | $10^{13}$ | *neel* | ten trillion |
| 10000 | *dash-sahashram (ayutam)* | ten-thousand | $10^{14}$ | *dash-neel* | one hundred trillion |
| 100000 ($10^5$) | *Laksh* | one hundred-thousand | $10^{15}$ | *padam* | million-billion |

| | | | | | |
|---|---|---|---|---|---|
| **$10^6$** | ***dash-laksham*** | **million** | **$10^{16}$** | ***dasha-padam*** | **ten-million-billion** |
| **$10^7$** | ***kror*** | **ten million** | **$10^{17}$** | ***shankh*** | **hundred-million-billion** |
| **$10^8$** | ***dasham kror (nyarbudam)*** | **Hundred million** | **$10^{18}$** | ***dash-shankh*** | **billion-billion** |
| | | | **$10^{19}$** | ***maha-shankh*** | **ten-billion-billion** |

A question arises as to why such large numbers existed in the Vedas and in Vedic civilization and why were they taught? There are several parts to the answer. One answer is in YajurVeda mantra cited above. For that answer to be acceptable one has to believe in rebirth. It is however interesting to note that the discovery of thousands of exo-planets in astronomy proves the second part of the mantra that there is life on some of the exo-planets, even if there is no rebirth system. The second part of the answer is that the Vedic tradition could not do without mathematics that they derived from the Vedas, including the invention of zero without which the world would not be the same today! The Sanskrit terminology of the numbers, with 7 zeros (kror) and up to 9 zeros (arab or arbud, a billion), still continues in India today in commercial and government budgetary expressions. The large numbers were also taught because at one point in the Vedic civilization the professional sciences were a part of the school curriculum in the *gurukulas* (centres of learning at gurus' *ashrams*). The term assigned to each unit in the above table shows the development of science and mathematics in the Vedic society for an extended period of time.

Some of the units of Vedic mathematics in the first column of the Table 5.2 with nomenclature in the second column relate to the well-known units in the third column used in the western civilization like thousand, million, billion and trillion. The same question when posed to the present civilization why such big numbers needed, yields the answer - *'necessity is the mother of invention'*. It is obvious from the Table 5.2 above that the nomenclature right up to $10^{19}$ was developed in the Vedic civilization in the far antiquity of the

Indian civilization that even had finer steps with proper nomenclature than the million-billion-trillion scale, jumping forward with three zeros at a time. The necessity must have been the mother of invention of the Sanskrit nomenclature too.

It is a generally accepted fact that the concept of zero originated from the Aryan Civilization in India. Zero is an entity that has no value of its own but it increases the value of a number by association. Aryans invented the concept of zero because it must have become a necessity for counting and dealing with large numbers. Even if they pulled it out of the Vedas, the credit for introducing zero in mathematics goes to them. The obvious fact here is that the Aryans generated acronyms of the units and utilized large numbers. It is further clear from the AtharvaVeda mantra (8/2/21) that states the period of creation. The first part of the mantra is presented below,

शतं तेऽयुतं हायनान् द्वे युगे त्रीणि चत्वारि कृण्मः ।...॥

(AtharvaVeda, 8/2/21)

**Word Transliteration and Translation:**

शतं (*shatam*) **=** one hundred, ते (*te*) **=** for you, अयुतं (*ayutam*) **=** ten thousand, हायनान् (*haayanaan*) **=** years, द्वे (*dve*) **=** two, युगे (*yuge*) **=** to add, त्रीणि (*treeni*) **=** three, चत्वारि (*chatvaari*) **=** four, कृण्मः (*krinmah*) **=** given to you/done for you, put sequentially **।**

In the context of the mantra the translation of this part of the mantra is:

*"One gets the age of creation by placing two, three and four before one hundred 'ayutam' years"*. (AtharvaVeda, 8/2/21).

In a typical Vedic mathematical way of expressing large numerals, the mantra requires one to build the number by proceeding from the lower place value to the higher (from right to left). An *ayutam* occupies 5 places of numerals and one hundred *ayutams* occupy 7 places of numerals. Since no specific numerals are assigned for the seven places, the instruction is to place 7 zeros first to occupy one hundred *ayutam* spaces and then place 2, 3 and 4 in that order going towards higher orders to get the required number. The result is 4,320,000,000 years. This, 4.32 BY (billion years), is the total age of the creation phase that the universe will last for. Although the present age of the universe, based on astronomical observations is determined to be 13.73 ± 0.12 BY, it is much bigger than the Vedic assigned age of the universe. Nevertheless, a figure such as 4.32 BY coming out of the ancient Vedic discipline of thought in science and mathematics is in the same order of

magnitude. This remarkable formulation on the creation period of the universe in billions of years is presented in AtharvaVeda in a beautiful poetic mantra structured in a unique meter

The figure of 4.32 BY as the Vedic age for the universe could not have been arrived at by mere chance or by fanciful imagination. The Vedic sage could have given a round figure such as 10 thousand or a million or even a billion years but the mantra formulation enunciates a specific number, the 4.32 BY. There must be a logical explanation behind this precise number.

The next sections under the Time-entity are devoted to its measurement.

# Measure of Time-entity: Large Time Scale of the Aryans

## Detailed Time Division of 4.32 Billion Years

The interesting feature of the Vedic age of the universe is that it is not just a lump-sum mathematical number of 4.32 BY; it is further divided into specific epochs of time called *yugas*. The *yuga* periods are not just another set of lump-sum numbers, the Vedic scholars suggest that the *yuga divisions are* like the seasons on Earth having their distinct natural character. Because the number 4.32 BY itself relates to the long-term astronomy this author's thinking is that they must have specific relationship to the long-term astronomical periods associated with the Sun's traverse and position in the constellations.

In the Vedic literature the detailed division of this period have been presented in quite a few ancient references, including the Manusmriti authored by the great King Manu of the far antiquity of Vedic civilization anterior to

Mahabharata (3140 BCE) and the books written after Manusmriti such as the Bhagvadgita (3140 BCE) and Surya Siddhant (The Sun Principle, author and time of writing not known). There are differing procedures used in each of these references to arrive at the same length of a *yuga* (a defined period of time) and the same final total of 4.32 BY. The details of time-division presented in this book are based on the book of Manusmriti. Manusmriti's time division begins from *nimesh* as the smallest unit of time which equals to 0.1778 second and goes right up to 4.32 BY.

For the sake of brevity Manu's *shlokas* on time division are directly translated from Sanskrit to English without detailed word for word translations. The time division from one day and upwards is presented first. The *shloka* (1/65) of Manusmriti states that:

> *"The Sun enables the division between human's day-night and the devic* (of the *devas*) *day-night where the day is for activity and endeavour by living beings and the night is for sleeping"*. (Manu, 1/65).

This is indicative of the time division by the natural system of Sun-rise and Sun-set. The important feature of this statement is that there are two kinds of day-night periods: humans' and *devas*'. This difference is stated in Manusmriti shloka (1/67):

> *"One year of humans is one devic day-night. The day-period of devas is when the Sun is udgayanam* (north of equator) *and the night-period of devas is when the Sun is dakshinaayanam* (south of equator)*"* (Manu, 1/67).

This remarkable shloka laid down by Manu right in the beginning of the Vedic civilization speaks volumes. It deals with the science of physics and geography to establish the time division. The time division on Earth relates to Earth's geography and the Sun's latitudinal position in the sky with respect to Earth's equator. The terms *udgayanam* and *dakshinaayanam* in this shloka specifically relate to the Sun's geographic latitudinal region or Sun's abode in the sky with respect to the equator of the Earth: *udgayanam* is for the Sun being in the northern hemisphere and *dakshinaayanam* is for the Sun being in the southern hemisphere. The term *udgayanam* in subsequent ancient astronomical Sanskrit also appears as *uttaraayan* with *uttar* for geographical north with the common suffix *ayanam* representing the place or abode. This

also tells us that the creator of the nomenclature, *udgayanam* and *dakshinaayanam*, Manu in this case, knew the dividing line between the two. This dividing line is the equator. The Sanskrit name for it is *vishuvat-rekha*. When one looks into the word meaning of the term *vishuvat-rekha* alone, one is pleasantly revealed that the ancient Aryans had tremendous grasp of physics, astronomy and geography. The terms *vishu* stands for "in two parts", *vat* stands for "similar to but not actual" and "*rekha*" stands for "line". When put together "*it is the line that divides in two similar parts but not real parts*". Obviously, it is the line dividing the Earth's globe into equal halves. The other Sanskrit dictionary meaning of *vishu*, in context of astronomy is "similar to equinox".

One wonders why Manu introduced two different time units in a single *shloka* (1/67), one human's and the other *devic*. It is obvious from the Vedas and Manusmriti that the ancient *rishis* including Manu had the knowledge of the Earth, that it was round, spinning around its axis and that the solar angle changed with latitude through the year, sending the Sun into *udgayanam* and *dakshinayanam* (northern and southern hemispheres). Manu realized that defining a full day by two equal halves (daylight and night-time) was not absolute because such a definition changes with time of the year and latitude of the place when the day and night are not equal. Whereas a day in the equatorial region of the Earth is defined to be the daylight period between sunrise and sunset, a day at the geographic pole is six months long and a night there is also of six months long. To have his definition applicable to the entire globe, pole to pole, Manu intentionally introduced two time units and related them within one *shloka*. This is the meaning of "O*ne year of humans is one devic day-night"* in the above *shloka*.

Appropriate terminologies have been employed to minimize any confusion in the definitions. To differentiate a day from a night the Vedic expression is *aho-ratra* (day-night), however, in the count of days in a Vedic year the 360 *aho-ratra* form one year which in common usage is 360 day *saur-varsh* (solar-year). Thus in the count of 360 solar-days at the equator, a day is inclusive of a day-night pair. All these time-units, time-scales, their nomenclatures and definitions prescribed by Manu in his Smriti have their root in the Vedas; which are considered by the Vedic people to be the ultimate reference. The Vedic *rishis* based their knowledge and derivations on the Veda mantras. The *shloka* itself makes it glaringly obvious that Manu had full grasp of Earth's geography and astronomy to have introduced astronomy terminology *udgayanam* (Sun in northern hemisphere) for six months and

*dakshinaayanam* (Sun in southern hemisphere) for six months. This *shloka* of Manu provides a time conversion factor: **1 *devic* day equals 1 human year**. It is also obvious that the Earth for Manu was a round globe as it has been in the Vedas. He had full knowledge of the daily variation in Sun's position causing change in the length of the day and night through the year.

To determine the onset of *udgayanam* and *dakshinaayanam* one needs to ascertain the dividing line between the two, the *vishuvat-rekha* (equator). Therefore Manu must have known where the equator on the Earth was. A brief discussion with references was presented in Chapters 1 and 4 on Manu being a globe-trotter with grasp of knowledge on global geography, global ecology and languages of societies exterior to Aryavart (India). The consideration of the Sun's position with respect to the equator indicates advanced astronomical knowledge of Manu and therefore of Aryans of the far antiquity. The deductions contained in the *shlokas* require knowledge of north and south sides of the globe and the dividing line. Manusmriti and the Vedic literature define a day between the sunrise and the sunset and a night between the sunset and the sunset and the sunrise to make a calendar day, as all do.

After relating the human year and *deva* day, Manu in the next *shloka* introduced the unit of Brahmn-day. While doing so he urged the scholarly *rishis* in attendance before him 'to pay attention'.

> "*Be attentive that now I will present to you in brief the measure of Brahmn's day and the measure of yugas one-by-one, kramashaha* (sequentially)!" (Manu, 1/68).

A *Brahmn*'s day is a Creator's day, a period of time during which the creation is in its active epoch of definable matter. Similarly, a *Brahmn*'s night is the period of time when the creation is in dissolved slumberous state. In the terminology introduced earlier, a *Brahmn*'s day is *srishti* (creation) and His night is *pralaya* (dissolution). The length of *Brahmn*'s day based on the AtharvaVeda mantra is 4.32 BY. A *Brahmn*'s day can be expressed in terms of human-years, *devic*-days or *devic*-years. A *Brahmn*-day is expressed in yet another unit called *yuga*. The meaning of the word *yuga* is the 'period' of time, however, a specific period of time has specific name for the *yuga*.

The word *kramashaha* (sequentially) in Manu's above *shloka* is for one to know four different *yugas* sequentially in the order of their duration. These

four *yugas* from the onset of creation successively are:

(1) *Kritam-yuga*, its more popular name is *Sata-yuga,*
(2) *Treta-yuga*
(3) *Dvapara-yuga*
(4) *Kali-yuga*

This unit of four *yugas* together sequentially cycles through one thousand times during one *Brahmn*-day which is the full age of creation. This means that the creation begins at the onset of the first *sata-yuga* (*kritam-yuga*) followed by the next three and at the end of the first *kali-yuga* begins the second *sata-yuga* and so on, till they all sequentially cycle through one thousand times in one creation.

Manu has considered a year to be of 360 solar days and not of 365 solar days as in the present. It is possible that the Earth did have a 360 day-year at the time of Manu and therefore the scale of a year was considered to be of the 360 days. This also stems from the fact that RigVeda mantras consider a year to be of 360 days. The significance of 360 day-year and its division into 12 months in relation to the division of Earth's orbit around the Sun being 360º will be discussed in the following. Here it would suffice to say that all numbers presented in terms of human, *devic* and *Brahmn* days and years are based on a 360 day-year. This means that while a human-year is of 360 solar days a *devic*-year being of 360 *devic*-days (at the North Pole) is 360 human-years long.

After defining one *devic*-day in the *shloka* (Manu, 1/67) as 360 human-days (one year) Manu in the *shloka* (1/69) presents the mathematical definition of a *sata-yuga* in terms of the main period plus the two union periods either side of it.

***Sata-Yuga*:**

"*In terms of those, devic-years, a sata-yuga is said to be of four thousand years, added to it is the sandhi (union) period before and after its fraction of four hundred years,*". (Manu, 1/69)

Therefore, according to Manu, along with two union periods, a *sata-yuga* is:

***Sata-yuga*** = *sandhi* + 4,000 *devic*-years + *sandhi* = 400+4,000+400 =4,800 *devic*-years.

From Manu (1/67), presented above, 1 *devic*-day (a day-night at the North-Pole) is 1 human-year at the equator with a Vedic definition for a year being 360 days, the above number can be represented in terms of human years. The sata-yuga period in terms of devic-days

= 4,800x360
=1,728,000 devic-days
=1,728,000 human-years

Therefore, a sata-yuga **= 1,728,000 human-years.**

Based on Manu's shloka (1/70) the other three yuga periods are calculated as following,

**Treta-yuga, Dvaapar-yuga and Kali-yuga:**

Manu's definition of these three yugas is:

"*For the remaining three yugas one gets their measures by subtracting sequentially a thousand from their main period and a hundred from their union periods*". (Manu, 1/70).

Its Mathematical summary is:

From Sata-yuga one gets **Treta-yuga =** (400-100)+(4,000 -1,000) + (400-100)

= 300+3000+300
= 3,600 devic-years
= 3,600x360 devic-days
= 1,296,000 human-years

In the same manner from treta-yuga one gets,
**Dvaapar-yuga** = 200+2,000+200
= 2,400 devic-years
= 2,400x360 devic-days
**= 864,000 human-years**
From dvaapar-yuga one gets **Kali-yuga**
= 100+1,000+100
= 1,200 devic-years
= 1,200x360 devic-days

**= 432,000 human-years**

Manu must have felt the need for clarification on what has been said in the above *shlokas* and therefore he elaborates further:

> "*This, what has been enumerated here for the chatur-yugam (four-yugas), is twelve-thousand divya (devic)-years. It is devas' one yuga"*. (Manu, 1/71).

Manu is stating that one *chatur-yugam* (four-*yuga*-period) of humans is equivalent to 12,000 *deva-years* which is termed as one ***deva-yuga***. This is 12,000x360 = **4,320,000 h**uman years. One gets the same figure by adding the measures of all four *yugas* presented above,

**1,728,000 + 1,296,000 +864,000 + 432,000 = 4, 320,000 years = 1 *devic-yuga***

It is obvious from this addition of four *yugas* that each is a multiple of the ***Kali-yuga*** as,

**4x432,000 + 3x432,000 +2x432,000 + 1x432,000**
**= 4,320,000 human years**
**= 4.32 MY**

The next shloka of Manu (1/72) defines the last unit of Vedic time-scale for cosmological estimates and *Srishti*-calendar,

> "*The number determined from one thousand deva-yugas is termed as one day of Brahmn and the same length of time is one night of Brahmn*". (Manu, 1/72).

The mathematical representation of this statement is,

1 *Brahmn*-day = 1000 *deva*-yuga = **4, 320,000 x 1000 human years =** 4,320,000,000 years **= 4.32 Billion Years (**BY)

Different nomenclatures and their relationships are summarized below:

(1) A set of four successive *yugas* is termed as a *chatur-yuga* or a *chatur-yugi*.

*(2)* In terms of the names of the *yugas* a *chatur-yugi* is:

*Sata-yuga + Treta-yuga + Dvaapar-yuga + Kali-yuga = chatur-yugi* = 4.32 MY

(3) *Chatur-yugi = Maha-yuga* (*maha* means big).

(4) *Chatur-yugi = devic-yuga, deva-yuga, divya-yuga* (all five synonyms for a *chatur-yugi* , each with the span of 4.32 MY.

This time period of 4.32 MY, the *devic-yuga*, is important in Vedic Cosmology because, as brought out in Chapter 8 on Vedic Creation Scenario, this is the time period needed for:

(a) the primordial matter (*Maartaand* = Mortal-ovate) to develop sufficient heat energy to explode in Vedic Big Bang and break into *koti-koti* (uncountable) smaller *Maartaands*,

(b) This is the time period needed after the Vedic Big Bang to establish order in the creation and for the living matter with root-system to first appears on the Earth.

This number, 4.32 BY, is the same as in the AtharvaVeda mantra (8/2/21) cited earlier. In that particular mantra a total for the number of years is given without time division in terms of *yuga* periods of different names and measures. Elsewhere in the Vedas some of the units of time mentioned above appear in differing contexts. Manu is found to be the first in the Vedic Literature to have presented a break-down of the total period of one *Brahman*-day, the full span of the creation phase of the universe. The above *shloka* (Manu, 1/72) also states that after each creation (*srishti*) follows Brahmn-night (*pralaya*) of the same length. In one of the shlokas Manu said that human-day is for activity and the night for sleeping. A *Brahmn*-day is for the *Prakriti* (Nature) to be in an active phase (awakened state) and after that recede into stupor during *Brahmn*-night. In a different context, Yogiraj Krishn also states in Bhagvadgita (8/17) that,

> *"Those who talk in terms of the definition of day-night and are scholars of the science of Time know that one day of Brahmn is of one thousand yugas and one night is of the same duration".* Bhagvadgita (8/17)

One thousand *yugas* in this shloka are one thousand *devic-yugas* which is the same as one thousand *maha-yugas* as defined above.

The ancient astronomy book "Surya Siddhant" (The Sun Principle) has given in its first chapter the basic definitions of the *yugas* and their relationships to each other in terms of numerical values and many other details. The basic definition and the numerical values of the *yugas* are the same as in Manusmriti. For example in the Surya Siddhant shloka (1/15) in particular, it has stated that, "*One chatur-yugi is equivalent to 12,000 devic-years which is equivalent to 4,320,000 solar years*". It has gone further talking about the orbital periods of the planets and how to arrive at the age of the universe and how many *yugas* and part thereof have elapsed since the creation of the universe began. Drawing more details here from the Surya Siddhant will distract the context of this chapter.

**Table 5.3: Vedic Time-scale for cosmology and important epochs in the history of creation (Manusmriti 1/69-73).**

| | No. of years | Unit Nomenclature | Comment |
|---|---|---|---|
| 1 | 1,728,000 years | 1 *Sata-yuga* | 4x *Kali-yuga* |
| 2 | 1,296,000 years | 1 *Treta-yuga* | 3x *Kali-yuga* |
| 3 | 864,000 years | 1 Dvapara-yuga | 2x *Kali-yuga* |
| 4 | 432,000 years | 1 *Kali-yuga* | 1x *Kali-yuga* |
| 5 | 4,320,000 years (sum of four above) | 1 *Chatur-yugi* (1 *devic-yuga*) | Also called a *deva-yuga* or a *deva-samvatsar* |
| 6 | Cycle of 1 to 4 repeats | → | 1,000 times during one creation |
| 7 | 1,000 *Chatur-* | 1 *Kalp* | Creation |

| | | | |
|---|---|---|---|
| | *yugis* (4,320,000,000 years) | (*Brahmn*-day) (1000 *samvatsar*) | period (beginning to the end of creation) |
| 8 | 1,000 *Chatur-yugis* (4,320,000,000 years) | 1 *Vi-Kalp* (*Brahmn*-night) (1000 *samvatsar*) | Opposite to *Kalp* = dissolution phase of the universe (end of creation to next beginning of creation) |
| 9 | 311.04 Trillion Human-years | 1 *paraant-kaal* | 100 *Brahmn*-years |

There is one more unit of time which relates to the period of salvation of the soul. According to the Vedic philosophy, the soul's privilege to be in 'eternal bliss', free from the vice of *Prakriti* (matter) and free from the birth-death cycle and the pain and suffering that come with it, is not forever. It is a predetermined period after which the souls in salvation come back to take birth in the creation. Swami Dayanand Saraswati in the 9th chapter of Satyarth Prakash discusses the subject of salvation (*mukti*) with a reference from Mundak Upanishad (3/2/6) and states that the salvation period is one *paraant-kaal,* also known as *maha-kalp*. This period is 100 *Brahmn*'s years.

1 *paraant-kaal* = 100 *Brahmn*-years → 100x360 *Brahmn*-days (day+night) → 100x360x4.32 BYx2 human-years → 311,040,000,000,000 human-years (311.04 Trillion human-years. This is shown in the last row of the Table 5.3. This number in Sanskrit mathematical terminology is read as: 31 *neel* 10 *kharab* 40 *arbud*. All calculations pertaining to the time units used in Vedic science and cosmology are summarized in the conversion Table 5.3.

It is important to note from the table that the *chatur-yugi* or 1 *deva-yuga* was equated to yet another term, *samvatsar*. There is reason for naming yet another term for the same time period because each term conveys a slightly different meaning. The generic term *samvatsar* is for a cyclic order. As an example the term *samvatsar* in context of short term cycle is for one orbit of the Earth around the Sun, which is the period of one calendar year. It was

mentioned in Chapter 3 that the Vikram-samvat started from King Vikramaditya, 57 BCE and the present Kali-samvat started from February 18, 3102 BCE.

The term *samvat* is short for *samvatsar*. In the context of the Earth, its *samvatsar* represents a perpetual cycle with the periodicity of one year made up of 12 months. In the context of the universe, its *samvatsar* represents a perpetual cycle of 4.32 MY made up of four different successive *yugas* that cycle through 1,000 times. All these perpetual cycles appear during the creation phase and disappear during the dissolution phase and the perpetual cycle of creation-dissolution or *srishti-pralaya* also continues with its periodicity of 8.64 Billion Years.

Let us take a few more steps to look into the Vedic cosmological time-line, where the 4.32 BY period has been further divided into different epochs of time that relate to the history of the Earth and its future.

## Manvantar Period and the Big Flood

The Earth due to its position on its orbit around the Sun cycles through well-defined seasons. Does the universe go through any cycles? Modern cosmology assigns an age to the universe but does not suggest that universe goes through or does not go through any long-term cycles. The only variation in universe's character according to Big Bang Theory is onetime change as five epochs discussed in Chapter 2 of which the first three end within 10 seconds of universe's life. No cyclic behaviour in the universe's life is observed or predicted in the modern Big Bang Hypothesis.

In Vedic cosmology, the universe began with its well-defined first era of *sata-yuga* to last for 1,728,000 years, followed by three other eras of specific periods. According to the Vedic cosmology, considerable resetting in the universe takes place at the end of each *maha-yuga* of four successive *yugas* totaling 4.32 MY. This resetting affects the Earth and thereby the history of the universe relates to the history of life on Earth. For the astronomical reasons presently unknown, the Vedic *maatalis* the scholars of time-science, related the history of the universe to life on Earth and grouped the age of the universe into bigger epochs of time giving them specific individualized names. The names are not only given to the epochs that have passed but given to those that are yet to come.

Vedic *maatalis* have grouped the 1000 *maha-yuga* (*chatur-yugis*) of the creation into 14 successive sub-divisions called *manvantars* of equal duration. In doing so the first three and the last three *chatur-yugis*, a total of 6, are separated as the *manvantar-sandhi* (union) periods and the middle 994 *chatur-yugis* are divided into 14 equal periods of 71 *chatur-yugis* in each *manvantar*. Therefore each *manvantar* period is 306.72 MY long. The specific names given to these 14 *manvantar*s are listed in the Table 5.4. A union period of 3 *chatur-yugis* (4,320,000 x 3) of 12,960,000 years each is shown at the beginning and at the end of the *manvantar* list in the table. The Vedic creation begins with the *Svayambhuva-manvantr* and ends with the *Bhautakya-manvantr*.

The two large union-periods in the Table 5.4 for the whole creation are different from the smaller sub-union periods that were used by Manu for formulating the *yuga* periods to arrive at the four different *yuga* periods. Life with root-system (vegetation) according to Vedic thinking (RigVeda, 10/72/3) first appears on the Earth in the first *deva-yug*a of 4.32 MY after the onset of creation and it takes two more *deva-yug*as of 8.64 MY for humans to appear. During the last union-period the situation on Earth and in the rest of the creation is said to be chaotic and disorderly, leading towards the dissolution of the universe. Although the Vedic calendar keeps track of the total 1000 *maha-yugas*, the thinking in the Vedic literature is that the useful period of the creation is during 14 *manvantars,* which is 994 *maha-yugas* (*chatur-yugis*).

The RigVeda mantra (10/97/1) from the "Vegetation" sukta is the basis for the three devic-yugas being used for the first union period. This RigVeda mantra states:

*"I know with certainty the names and places of 107 medicinal vegetation of deep red colour that were born first in three deva-yugas prior to the birth of humans".*(RigVeda, 10/97/1).

Important point to note is that the Veda did not say that the humans were born first who sowed the seeds giving birth to vegetation. Therefore, the sequence assigned by the Veda to the birth of vegetation and humans is logical, scientific and therefore is remarkable.

The Vedic rishis have upheld that a Big Flood takes place on the Earth after each *manvantar* which destroys most of the establishment and civilizations on the Earth, forcing a new beginning in the order on Earth. This Big Flood is termed as the "**Jal Plaavan**". This author has not been able to find from the Vedic literature a scientific basis for the cause of the **Jal Plaavan** occurring with the frequency of a *manvantar*, 306,720,000 years each. The

Biblical story of a Big Flood is well-known when Noah saved the humans and animals in his ark. The Biblical Big Flood according to the Bible occurred about 3,000 years BCE and there is no mention that such Big Floods occur periodically with specific frequency, as given in the Vedic time-line of about once every 307 million years.

It is intuitive to suggest that the source of this *manvantar*-periodicity bringing a Big Flood on the Earth could be within the solar system, originating from either the heat-cycles within the Sun raising the waters of the oceans or the astronomical positioning of the planets and asteroids. The flood occurrence having a long period over 307 million years also inspires one to think of a cause beyond the solar system.

Just as the duration of time required for the Earth to orbit once around the Sun is termed as the 'terrestrial year' or the 'solar year', the duration of time required for the solar system to orbit once around the centre of the Milky Way Galaxy is termed as the 'galactic year', also known as the 'cosmic year'. The duration of a galactic year being about 250 MY is of the same order as the manvantar frequency of 307 MY. At the present time it is not known as to what all hurdles of cataclysmic proportions are in the orbit of the Sun carrying its solar system, while completing an orbit around the galactic centre?

**Table 5.4: Fourteen *manvantar* names and their durations**

| No. | Manvantar Name | Duration (years) |
|---|---|---|
| | First sandhi-period | 12,960,000 |
| 1 | Svayambhuva | 306,720,000 |
| 2 | Svarochish | 306,720,000 |

| | | |
|---|---|---|
| **3** | **Ottami** | **306,720,000** |
| **4** | **Tamas** | **306,720,000** |
| **5** | **Raivat** | **306,720,000** |
| **6** | **Chakshush** | **306,720,000** |
| **7** | **Vaivasvat** | **306,720,000** |
| **8** | **Saavarni** | **306,720,000** |
| **9** | **Daksh Savarni** | **306,720,000** |
| **10** | **Brahm Savarni** | **306,720,000** |
| **11** | **Dharma Savarni** | **306,720,000** |
| **12** | **Rudra Putra** | **306,720,000** |
| **13** | **Raucha** | **306,720,000** |
| **14** | **Bhautyaka** | **306,720,000** |
| | **Last sandhi-period** | **12,960,000** |
| | **Total Creation Period** | **4,320,000,000** |

The smooth rotation of the Milky Way Galaxy with all stars running in their respective tracks may suggest that there cannot be any possible hurdle in the track of the solar system to cause catastrophic event resulting into a Big Flood on the Earth. However, there is a possibility that on each orbit around the Milky Way our solar system passes through some severe gravitational hurdle owing to another star or another galaxy causing the Big Flood on Earth. Let us analyze the long-term periods.

The Big Bang is said to have taken place 13.8 BY ago and the Sun was formed only 4.14 BY ago. If one assumes that the Earth was also born along with the Sun, it took a while before the oceans collected water on Earth. It is estimated that the oceans appeared about 3.937 BY ago. Now if we use 250 MY for each solar orbit around the galactic centre, the solar system orbited around the galactic centre about 3.937 BY/ 250 MY = 15.75 times. If the solar system faces at least one catastrophic hurdle on each orbit causing Big Flood

on the Earth, there would be about 16 Big Floods in about 4 BY. This is too many compared to the Vedic count of 14 in the entire life of the universe.

Even though there is no relationship between the modern cosmology/astronomy and the Vedic cosmology/astronomy, surprisingly the order of magnitude of the age of the universe is in billion years in both. The Vedic numbers stipulate 14 *Jal Plaavans* (Big Flood) in 4.32 BY period of the life of the Vedic universe. The number 14 in the Vedic stipulation and 16 over a period of about 4 BY with one hurdle on the orbit of the Sun is interesting to note.

Whatever the cause for a Big Flood, if it has any relation to the orbit of the solar system around the galaxy and if the Vedic contention is right that the Big Flood frequency is about 307 MY, it should be of interest to geologists to look for a 307 MY periodicity in the Earth's crust and if possible in the crusts of all planets of the solar system. According to Vedic calculations 7 *manvantars* have elapsed yielding 7 Big Floods. Geologists should look for at least 7 scars in the crust of the Earth separated by 307 MY.

One could think of several reasons for one-time or occasional Big Flood in the life of the Earth. A big meteorite impact in the ocean could create a gigantic global tsunami. However, the *Jal Plaavan* phenomenon mentioned in the Vedic literature being a long-term periodic phenomenon with the frequency of occurrence of about 307 million years, the probability is that the cause for Big Flood would be found outside the solar system.

## Prediction of the Subsequent Big Floods

According to the Vedic *srishti* calendar, we are in the 7$^{th}$ *manvantra* of Vaivasvat. The time elapsed since the beginning of the Vedic creation is **1,972,949,118** (≈ 2 BY) years in 2018 CE. The 6$^{th}$ Big Flood since the beginning of creation was at the end of Chakshush-manvantar (Table 5.4). By accounting for one union period of 12,960,000 years, the last Big Flood occurred 145,589,118 years ago in 2018 CE. In the coming period we may get some devastating floods which occur unpredictably every now and then, however, according to the Vedic prediction, the next Big Flood (*Jal Plaavan*) will occur 161,130,882 years in the future at the end of the present manvantar. It is worth examining on a scientific basis whether such a catastrophic event as the Vedic ascribed Big Flood, with a periodicity of 306.72 MY, is a real event due to the Earth and the solar system being at a specific position within our galaxy.

Contemporary astronomers have suggested that almost all observed galaxies are older than 2 billion years with their arms formed of stars gone around their axes over 8 times. The Vedic time division of creation into 14 *manvantars* of which 6 *manvantars* have already been lived means that there have been 6 Big Floods of cataclysmic proportions leading to seven rejuvenations of living creation on the Earth. This closeness of 8 times rotation of most galaxies and 6 times renewal of the living creation on Earth after a Big Flood is quite intriguing to note.

## Long-term Seasons in the Creation

In addition to the Vedic prediction of a periodic occurrence of Big Floods several questions on the time division of the Aryans arise. Notice that the Vedic creation period of 4.32 BY is divided into numbers that are the even-fractions of this big number, a *maha-yuga* (*chatur-yugi*) being $1000^{th}$ of it. Then a *maha-yuga* of 4.32 MY is further divided into four *yugas* not of equal duration but in multiples of 2, 3 and 4 of the *kali-yuga* period of 432,000 years. The obvious question is regarding the specific and differing duration for the four *yugas* put in sequence and why the same period of 4.32 BY was divided into the 14 *manvantars* of equal and specific duration? There is considerable indication in Vedic literature about the answer to this question, even though presently that answer only remains academic.

One observes in Nature that it is inundated with periodicity at all its levels beginning from a tiny electron orbiting a nucleus of an atom to the Sun orbiting around the centre of our galaxy carrying with it the entire solar system. Therefore, it is possible that the Big Flood is part of the periodicity that occurs for certain astronomical reasons. The Veda has divided Earth's year into 6 seasons which have been named according to the specific changes they bring on Earth. The 14 *manvantars* separated by the periodicity of 306,720,000 years may have something to do with our solar system's position on its orbit around the Milky Way Galaxy. This is like the existence of sub-harmonic waveforms within a resultant waveform. What the Vedic system has certainly done here is to arouse the curiosity in the enquiring minds to examine these Vedic ideas employing modern science tools and methodology. One has to wonder why the *rishis* chose to divide the period of billions of years into specific periods. They certainly did not indulge in this incredibly complicated mathematical maneuvering for fun!

# Deductions

- The creation period is divided into *yugas*, cycling through 1000 times. Whole creation period is further divided into 14 *manvantars* of 306,720,000 years each (306.72 MY).

- Earth suffers from a Big Flood at the end of each *manvantar* and periodically renews the living creation on it.

- Since the onset of the Vedic creation, the last $6^{th}$ Big Flood occurred about 145.59 MY ago and the next one will occur in 161.13 MY.

# Time-keeping by the Aryans

If the Aryans have carried forward the four Vedas intact for thousands of years, with no change even in one syllable of a mantra, the Aryans were also capable of carrying forward their time-counting process. Based on their astronomical observations, discussed in Chapter 11, they have been preparing calendars for yearly, monthly and daily use with the accuracy of *kaashtha* (3.2 seconds) in time (Table 5.5) and within seconds of arc ($1/3600^{th}$ of a degree) in angular positioning of the celestial objects on the celestial sphere, observed all around us as the dome with fixed constellations on it. They have been aware of the fact that the *Kaal* (Time) brings changes in the society and cataclysmic events create drastic discontinuity in the smooth functioning of the society, affecting its learning process and the knowledge base. Along with extracting knowledge from the Vedas and bringing it to a level that is common to all in the society, the Aryans of Aryavart devised means and ways, to preserve the Vedas and the Vedic practices. Much can be written on the safeguards devised by the Aryans to protect the Vedas and the Vedic knowledge; just a few points related to time-keeping by the Aryans are noted here.

In the ancient Aryan tradition that still continues in India, an auspicious ceremony generally **begins by invoking a specific *shloka,*** called the '***sankalp-shloka***'. This *shloka* is to establish the geographic and time coordinates of the event. An example of a *sankalp-shloka* is in the following when this author on August 4, 2013 recited it to begin his lecture on physics in the Vedas as:

> ओ३म् तत् सत् श्रीर् ब्रह्मणो द्वितीये प्रहरार्ध्दे, वैवस्वते-मन्वन्तरे अष्टाविशंति-तमे कलियुगे, कलि-प्रथम-चरणे, एक वृन्दः - षण्णवति कोटिः, अष्ट लक्षः, त्रिपञ्चाशत् सहस्रे, चतुर्दश - उत्तर - शततमे (1, 96, 08, 53,114) सृष्टि सम्वतसरे , कलि सम्वतसरे पञ्च सहस्र चतुर्दश उत्तर शततमे (5,114), भूमण्डलेस्थिते उत्तरपाताल-उपखण्डे, कैनाडा देशे तस्मिन्-स्थिते टोरोन्टो नगरे तत्रस्थ स्कारबोरो-उपनगरे, उत्तरायणे पुनर्वसु नक्षत्रे, वर्षाऋतौ आषाढ़ मासे कृष्ण (शुक्ल) पक्षे तृतीयायां तिथौ रविवासरे प्रातः(सायं) काले,

शुभमुहूर्ते, अहम् शिवराजपालः, भौतिकविज्ञान-विषये सर्वविज्ञानार्थं स्वकीयान् विचारान् भवत् भद्र-स्त्री पुरुष समक्षे प्रकटयामि।

**Transliteration:**

**"***Om tat sat shreer brahmno dviteeye prahraardhe, vaivasvate-manvantare ashtaavishanti-tame kaliyuge kali-pratham-charne, ek vrindah-shanvati kotih, asht lakshah,tripanchashat sahashre chaturdash-uttar -shatatame* (1, 96, 08, 53,114) *srishti samvatsare, kali samvatsare panch sahasra chaturdash uttar shatatame* (5,114), *bhoomandale-sthite uttar-pataal-upkhande, Canada deshe tasmin-sthite Toronto nagare tatrasth scarborough-upnagare, uttarayane punarvasu nakshatra, varsha ritau aashaadh maase krishna (shukla) pakshe tritiyayaam tithau ravivasare pratah (sayam) kale, shubhmuhurte, aham shivrajpalah, bhautic- vigjyan-vishaye sarvavigjyanaartham svakeeyaan vicharan bhavat bhadra-stree-purush samakshe prakatyaami."*

**Translation:**

*Om - O Eternal Brahmn with you in my heart, in the second quarter of your creation day, in the Vaivasvat Manvantar period of the creation history, in the 1st step of the twenty eighth Kali Yuge, in the Creation Calendar year of* 1,96,08,53,114 (1.96 BY), *in the Kali Yuga calendar year of* 5,114, *in the Scarborough suburb of the city of Toronto, situated in the country of Canada in the North American subcontinent on the globe, when the Sun is in the northern hemisphere in the constellation of Punarvasu during the rainy season on the Sunday on the third day of the dark lunar phase of the month of Aashaadh, I, Shiv Raj Pal, recite this 'sankalp-shloka' to commence this auspicious occasion to express my thoughts on physics for your knowledge, respected ladies and gentlemen.*

Notice that in this *Sankalp Shloka* the date of the *sankalp* is expressed in the year of the Srishti Calendar (Natural creation calendar of the Aryans) and the day of the *sankalp* is expressed in terms of the position of the constellation within a *muhurta*, which is approximately on an hourly basis. The solar-*ayan* (hemispherical) position is assigned to the day. The day is also expressed in terms of the position of the place on the globe and is also related to the lunar phase (bright or dark) with the ongoing social calendar of the place, in the Vikramaditya Era calendar. Not only that, the name Vaivasvat of the *manvantar* period ($7^{th}$ in Table 5.4) is recited with the number of the currently ongoing $28^{th}$ *Maha-yuga*. The details recited in the shloka are quite elaborate and scientific in nature. Therefore this system is remarkable. It is amazing that this practice of reciting the *sankalp-shloka* prevails with the priestly brahmans throughout India, even deep in the countryside. Swami Dayanand Sarasvati in his book, the 'Rigvedadi Bhasyabhumika' presented a sample of such a *Sankalp Shloka* for those readers desirous of learning it and preparing it for special occasions. There he also stated that- "… *the Aryans of India have been incrementing and recording the Srishti-Calendar in the same manner as the ledger books are kept up to date in the society*".

## Measure of the Time-entity: Small Time Scale of the Aryans

Large numbers with the scientific notation and the nomenclatures in the Vedic system and the Western system were presented in Table 5.2. The smaller units below one are also expressed in the science notation, millisecond and micro-second being the examples. The scientific notation is used with negative exponent to the base 10 when the numbers are extremely small. Did Aryans have smaller time-scales to represent small time units? Yes they did. Based on the discussion presented below one would find it mind-boggling as to how did they arrived at some units with the accuracy that could not have been possible without an accurate and difficult experiment in physics; the unit of *nimesh* being an example!

In addition to the large units of numerals and time presented in Tables 5.2 and 5.3 the Aryans have also dealt with the minuteness of the *Kaal* (Time-entity) and developed time units below a day, hour, minute and second. Modern physicists have been able to measure time in the order of femto-second ($10^{-15}$ sec) going down to atto-second ($10^{-18}$ sec, 1 divided

by a number with 18 zeros after 1). The Vedic units do not go as low as these science units, however, they exhibit that the Aryan approach for dividing the time in specific proportions was very scientific. Manusmriti's *shloka* from its Srishti (Creation Principle) chapter presents the nomenclature of five time-units and gives the conversion factor between adjacent units. The shloka begins with the smallest practical Vedic unit of time named *nimesh* and ends with *aho-raatram* (day+night).

निमेषा दश चाष्टौ च काष्ठा त्रिंशत्तु ताः कला ।
त्रिंशत्कला मुहूर्तः स्यादहोरात्रं तु तावतः ॥ (Manu, 1/64)

**Transliteration:**

"*Nimesha dash chaashtau cha kaashtha trinshattu taah kala*.

*Trinshatkala muhurtah syaadahoraatram tu taavatah*".

The shloka is translated directly into the first five rows of the Table 5.5. The nomenclature of time units with conversion factors between each successive unit is the same as in Manu's *shloka*. Since the units are sequentially recited by Manu with conversion factors, a conversion from one to any other would also be straightforward.

The first five items in this table being those in Manu's *shloka*, this author calls it as Manu's table. The details of the conversion factors in Manu's table show that the ancient *rishis* were quite advanced in physics and astronomy where such fine time divisions were needed; or why else did they develop such time conversion factors?

| **Table 5.5: Vedic Unit of Time from nimesh to one day and to one year** | | | | |
|---|---|---|---|---|
| | Unit of Time | Conversion | Common unit | Comment |
| 1 | 1 *nimesh* | | 1 nimesh = 8/45 sec = 177.777 millisec | Derived from time taken by 1 blink of the human eye |
| 2 | 1 *kaashtha* | 18 *nimesh* | 3 sec +200 millisec | |
| 3 | 1 *kala* | 30 *kaashtha* | 1 min and 36 sec | |
| 4 | 1 *muhurt* | 30 *kala* | 48 min | |
| 5 | 1 *aho-ratra* (*divas*) | 30 *muhurt* | 24 hr (day+night) | Shatpath Br. (10/4/313-24) 10800 muhurt in 360 days |
| 6 | 1 *paksh* | 15 *aho-ratra* | ½ month (15 days) | |
| 7 | 1 *maas* | 2 *paksh* | 1 month | |
| 8 | 1 | 6 *maas* | ½ year (6 | Uttarayan |

| | | | | |
|---|---|---|---|---|
| | *ayan* | | months) | –Sun in N-hemisphere. Dakshinayan – Sun in S hemisphere |
| 9 | 1 *varsh (manav)* | 2 *ayan* | 1 year (human's) | 1 deva-day (at the pole) |

The columns 2 and 3 present the Vedic names of the time-units and their relationship to the next higher unit. The column 4 gives corresponding modern equivalent to the Vedic units. The common unit of 1 day in the 5th row of the table provides direct relationship between the Vedic unit of 1 *aho-ratra* (*divas*) = 30 *muhurt* = 24 hr = 1 day (day+night). Using this correlation the value of 1 *nimesh* is exactly 8/45 second (about 178 milliseconds).

It may be mentioned here that in addition to the time classification laid down by Manu, several other small units of time have also been used in Vedic time measurement and applied to practical astronomy. They are: *truti* (0.5 *nimesh;* about 0.09 sec), *praan*, *pul, vipul* etc. Based on the definitions of the time units in other *shlokas* in Manusmriti and those in the ancient text 'Surya Siddhant' (Sun Principle), this author has added the last four rows in the Table 5.5.

It is obvious from the table that the Aryans developed a very comprehensive list of time units covering time-scales smaller than a day. These units have been in use since ancient times for astronomical calculations to prepare astronomical tables. These units were also used to prepare calendars and to record special historical events in the society. An important feature of the Table 5.5 is the smallest time unit of nimesh that takes us to about 1/6th of a second and more accurately to 177.777 milliseconds.

## The Mind-Boggling Case of Nimesh (निमेष): the unit of time

Just as the present civilization divides a 'day' into four units– day, hour, minute, second with the factors of 1, 24, 60, 60 the ancient king Manu in his book of Manusmriti furnished 5 time-divisions from a day: day (*aho-raatra* = day+night), *muhurt, kala, kaashtha*, *nimesh* with the factors of 1, 30, 30, 30, 18. Observing the Vedic time-scale of Manu one finds that an unmatched number 18 is part of the scale for the last unit of *nimesh* and not 30 to make it uniform. Why not a uniform time division of 30 *nimesh* in a *kaashtha*?

The discussion in this section will show that the time unit of *nimesh* (**निमेष**) is a derivative of the applied physics and not a theoretical factor of 30. The *nimesh* is being labeled here as the 'mind-boggling case' because unlike hoards of other science thoughts and principles that one comes across in the Veda mantras, the word *nimesh* would have been formulated following Sanskrit grammar but the time unit of *nimesh* could not have become possible without going through arduous yet accurate experimentation in science involving time measurement and human physiology. Since the time unit of *nimesh* is an incredible ancient outcome of applied science it is analyzed in the following to show what all incredible possibilities existed in the distant past of the Vedic Civilization.

The word *nimesh* appears in the Vedas often for the blink-function of an eye (e.g. YajurVeda, 23/3) and considered to be a vital physiological function in a living being. As we know it now that the blinking of an eye is involuntary action generated by the physiological necessity to moisten the eyeball. For this important physiological function of the human body even a prayer for its health is offered in the mantras.

The Vedic term *nimesh* (**निमेष**) represents a verb for creating specific motion of the upper eyelid. The prefix *ni* (**नि**) in it represents 'down'. The conjoined word *ni-mesh* means – '*down-ward motion of eyelid*'. The term *mesh* (**मेष**) also includes the action of striking. So the alternate meaning of *nimesh* is – '*down-ward strike of eyelid*'. The word *nimesh* conveys with clarity the downward strike by the eyelid.

The term *nimesh* does not represent both actions of the eyelid – closing and opening. Because the closing and the opening of the eye are opposite actions, the Sanskrit being a perfect language has two separate terms for them. While the eyelid striking down is *nimesh* the reversal of the eyelid to open the eye is *unmesh* (**उन्मेष**) with the prefix *un* (उन) replacing the prefix *ni*

(नि). The sound of the word *unmesh* (उन्मेष) is in fact closer to *oonmesh*. It is also worth noting that the prefix *un* before a verb generally reverses the meaning in languages other than Sanskrit. This usage may have gone from Sanskrit grammar to other languages for undoing an action; examples being – kind and unkind, known and unknown etc. In Vaisheshik Darshan (2/1/4), its author Rishi Kanaad lists 12 signs of the presence of the soul in a living body. In that reference Kanaad Rishi states that *nimesh* and *unmesh* are two separate actions in a living being. The *nimesh* is the time taken by the eyelid to strike the lower eyelid and not the blink rate of the eye.

The main action in this physiological necessity is the strike of the eyelid; its recovery being secondary. The action of the eyelid is quite similar to the strike of a hammer wherein the action starts from hammer's topmost position and ends when it makes contact with the object being struck. In this scenario, the time taken for the strike is of essence rather than the time taken to raise the hammer. The time of the strike by the eyelid is the time it takes for the one-way motion – the downward motion. With regard to *nimesh* becoming a part of the timescale of the Aryans, the ancient *rishis* must have first discovered that a *nimesh* of the human eye was smaller than a *kaashtha* (item- 2 in Table 5.5), which is 3.2 seconds long. Then they must have found out that there are 18 *nimesh* in a *kaashtha*. This makes a *nimesh* to be exactly $8/45^{th}$ of a second. Considering that *nimesh* is an ancient unit of time, for all practical purposes it is a remarkably small time resolution that the ancient *rishis* practically achieved.

For a measurement of blink-time one needs a starting reference time and a time-device to click time exactly when the upper lid strikes the lower. How did Manu do this experiment? All these questions are in the realm of physics yet the answers to these questions are not easy. This is why the unit of *nimesh* is 'mind-boggling'.

For measuring a *nimesh*, even today one needs high-tech sophisticated instruments and timing devices. It is easy to count how many times a normal human eye blinks during one day or in one hour but measuring and assigning absolute time to the blink itself is another story. The *nimesh* is the time taken by the upper eyelid to strike the lower in one blink.

Compared to a *nimesh* being about 178 milliseconds, let us check out derived values of the blink-time of an eye based on modern methodology using advanced technology. There are differing methods that the modern

scientists have employed to determine the blink-rate and the blink-time has been a byproduct of the experiment.

## Blink-Rate and Blink-Time Measuring Technique and the Nimesh

Without reviewing different methodologies for determining the blink-time, cited here is one of the most recent techniques that employs photo-detection with digital cameras with known frame rate to detect movement of the eyelid. The computer interface of camera images yields a statistical measure of both, (a) the blink-rate of the human eye derived from the blink count over a period of time and the blink-time of human eyelid (see e.g. Grauman et al. 2001, 2003; Chau and Betke, 2005) by resolving the short time duration of the blink. In these and all other modern experiments, the blink-time is defined to be the time taken by the upper eyelid from the start of the upper eyelid, striking the lower eye-lid and receding back to its original position. This definition of blink-time, including both the actions of the eyelid, is different from what the *nimesh* (eyelid coming down to close the eye) is. Once the difference between the modern and Vedic definitions of the term 'blink' is established, let us now look at the relationship between the Vedic *nimesh* and the time measurement of the blink by modern technologies.

The laboratory measurements yielded a statistical range for the blink-time (*nimesh* + *unmesh*) for a normal human eye to be about 300 to 400 milliseconds; about twice as much as the Vedic *nimesh* of 178 milliseconds. For practical purposes the time elapsed either side of complete closing time of the eye is symmetric and is about the same. Therefore a *nimesh* with eye-closing time is about half of the total blink-time measured in these modern and accurate experiments. Therefore the measured statistical range for *nimesh* is 150 to 200 milliseconds, giving an average of 175 milliseconds. Within statistical errors of modern measurements Manu's *nimesh* of 178 milliseconds is exactly as it is supposed to be. **This is not an ordinary**

**result.** Whichever way one looks at it, the numbers that the modern science has generated and the number that Manu has provided are remarkably on the dot. Obviously, Manu was a good physicist. One can draw an easy conclusion here that the case of *nimesh* is intriguing and that the ancient *rishis* knew more than we think!

## Commentary on Vedic Time Scales

A close look at the Vedic time units in the practical timescale (Table 5.5) makes it obvious that the units of day (day-night), *muhurt, kala* and *kaashtha* are not ad hoc; they are products of experiments and invented for practical use. The Table 5.2 based on the Vedas indicates that the Aryans carried out their counting in the decimal system going from zero to extremely high levels of billion-billion. The division of the unit of 'day' into *muhurt, kala* and *kaashtha* with a factor of 30 is meaningful and indubitably well-advanced. King Manu and his Manusmriti are considered by the Hindus to be among the most ancient sources of knowledge (details in Chapter 3). Therefore the time-division is extremely ancient anterior to the historic milestone on February 18, 3102 BCE. Even the age assignment for the creation being 4.32 BY is an unexpected figure.

Why did the ancient Aryans finalize a time scale from a day down to *muhurt, kala, kashtha* in multiples of 30? There may be other explanations for that particular division; this author suggests the following possibility.

It was expected that the Aryans would extract knowledge regarding time and space from the Vedas and further develop it. To have it accepted and finalized throughout Aryavart must have necessitated a discussion among the scholarly people as to how to ultimately put such a knowledge base in practice for the greater good of the society. To solve the problem of how to divide time and make it acceptable to all, they must have looked into the Vedas which were before all writings, including the Manusmriti. There are numerous mantras in the Vedas that would have guided the ancient Aryans of India in developing the foundation of their timescale on. There are several relevant mantras in the 164$^{th}$ *sukta* of the Chapter 1 of RigVeda; however, just two mantras are presented here, RigVeda (1/164/11, 48). The author suggests the reader to also explore AtharvaVeda's section (10/8/4). The RigVeda mantras have been extensively interpreted by the ancient

Rishi Yask in his Nirukt Shastra (4/27). The translations of the two RigVeda mantras reflecting Rishi Yask's interpretive commentary are as following:

> *"Know from this creation the un-weakening wheel of samvatsar* (year) *circling (chakram-pari) the Sun and having twelve sectors where ritam* (the creation principle) *in communion with the samvatsar, has produced seven hundred and twenty offsprings"* (RigVeda, 1/164/11).

> *"Know it by discussion and logic that it is the single-most wheel of samvatsar* (year) *with three foci that has twelve pradhi* (circum-sectors in togetherness) *and three hundred and sixty saakam* (spokes) *firmly implanted. They 'move' with time as one system and yet 'move not'"* (RigVeda, 1/164/48).

Once we know that the Aryans' practical *samvatsar* (year) was of 360 days, the meaning of the two mantras becomes obvious. According to Rishi Yask's interpretation, the 720 offsprings in the first mantra are 360 pairs of day and night and the 12 sectors of the wheel are 12 months of the year. This is made clearer by the second mantra in that the *samvatsar* is made up of 360 days (day+night) with 12 months out of a *pradhi*. The word *pradhi* stands for circumference of a circle. When used in plural the term *pradhi* represents sectors of the circumference. In the case of a wheel when *pradhi* is used in the plural sense, as in the mantra, the 12 *pradhi(s)* are 12 sectors of the rim forming the whole wheel. While providing etymological interpretation of these mantras Rishi Yask in a typical style of posing a question to himself or to his disciples, asks - '*why pradhi*?', then he provides the answer, '*pradhi, because they move together as one system*'. A wheel is not strong if all *pradhis* are not joined by the spokes to the central hub of the wheel. Therefore, the mantra states that it is the 360 *saakam* (spokes) that hold the wheel together. The emphasis in the mantra is that these 360 spokes are 'firmly planted' in the wheel. Rishi Yask refers to

Brahmana books, in his Nirukt and states that these 360 spokes are symbolic of 360 solar days in the *samvatsar*, which add up to one year. These 12 *pradhis* and 360 *saakams* in the *un-weakening wheel*, functioning under the *ritam* (Creator's principle inherent in Nature) thus form invariants of the *samvatsar* (year).

The three foci in the mantra are interpreted by Rishi Yask and the Brahmana books as the three main seasons: summer, rainy and fall. In the second mantra the meaning of '*move*' and '*move not*' of the system of the *saakams* and *pradhis* (spokes and sectors) is now obvious. They '*move*' because they are in perennial motion (cycle) and they '*move not*' because they do not become loose. Implicit here is that the process of the yearly cycle is like a rotating wheel without the need for service or repair unlike an ordinary physical wheel fraught with decay.

The Veda mantras and Brahmana books of the Aryans led them to establish a working time division for the year. The 360-day-year on a circle (the *chakram* in the mantra) corresponds to one degree of arc for one day. The division of a circle into 360 degrees can be found in Vedic literature far back in ancient literature including Vedvyas's book on Mahabharata 3140 BCE, in which he stated himself that from the bank of the River Sarasvati, he was making observations 'day in and day out' of the planetary positions. This was possible only when fine angular resolution of astronomical objects was derivable. Some details on this subject were presented in Chapter 3 under the sub-heading of "Sarasvati and Astronomy in Mahabharata". Observations of such astronomical events were not possible without the knowledge, practice and instrumentation in geometry and trigonometry, including the division of angles in an arc of a circle. Since no books are found to be older than the Vedas, a high possibility is that the concept of 360 degrees in a circle originated from the Vedas and travelled to the other Western regions of the globe.

The *schloka* couplet (1/28) in the ancient book on astronomy, the Surya Siddhant (The Sun Principle) states explicitly the angular division of a circular orbit of a planet as:

> "*A complete circle* (orbit of a planet) *is* 1 *bhagan;* 12 *raashi* in 1 *bhagan*; 30 *ansh* in 1 *raashi*; 60 *kala* in 1 *ansh*; 60 *vikala in 1 kala"*. (Surya Siddhant, 1/28).

Translation of the same in terms of modern terminology is:

> *A complete circle is 1 orbit, 1 orbit is divided in 12 sectors of 30$^o$ each, 60 minutes* (of an arc) *in 1$^o$ and 60 seconds* (of an arc) *in 1 minute* (of an arc).

The 12 *pradhis* and 360 *saakams* of the RigVeda mantra are thus the same as Surya Siddhant's 12 *raashi* in 1 *bhagan* with each *raashi* being 30$^o$ which is same as 360$^o$ in 1 orbit (*bhagan*). The term *bhagan* in common language is "the run" which is in context of a planet. Therefore, 1 *bhagan* means 'one run' of a planet which is 1 orbit of the planet. The Veda and the Surya Siddhant make it abundantly clear that one circular path of a planet is divided into 360 small sectors of 1$^o$ each and 12 sectors of 30$^o$ each with their Vedic nomenclatures.

Therefore there is clarity in the choice of 30 *muhurta* in a day (not 24 hours). It begins with the above cited Veda mantras wherein 12 *pradhis* (sectors) of a circle correspond to a sector of 30$^o$ each, which correspond to 30 days in a month of 360 day-year. The factor of 30 day in a year is extended to 30 *muhurta* in a day and so on and other divisions are also carried out with a factor of 30. Using a judicious mixture of time-units and angular units, the Aryans have been predicting angular positions of astronomical objects and even now printing in yearly *panchaangs* (five-limbed almanac).

The astonishing case of *nimesh* discussed above lends further support to this author's view that the ancient Aryans had a strong experimental base and devised ways and means to derive precise time and angular units. Their experiments certainly covered a wide range of subjects from the cosmos to the phenomena very near. The 18 *nimesh* in one *kaashtha* based on blink-time of the human eyelid is an evincing example of experimental superiority that existed in the far antiquity of Vedic civilization. The details of the methodology for measuring *nimesh* remain a mystery.

# (5) The Space-entity (*Aakaash-tatva*)

The Space-entity in Vedic cosmology is as important as it is in modern cosmology. The difference however is that one gets to learn more about the properties of the Space-entity in Vedic cosmology. A good amount of discussion on the Space-entity is preempted in Chapter 1 and 2. The idea of Space being an entity by itself, separate from the Nature-entity (matter-energy) and the Time-entity is relatively young in modern science. Well before the fog cleared from the idea that the Space was an entity when the space-time continuum and the Theory of Relativity by Einstein was introduction in 1916 CE, the great Vedic philosopher and thinker of the 19$^{th}$ century, Swami Dayanand Sarasvati quoted in his book of Satyarth Prakash (1881 CE) a statement on Space-entity that has been preserved in the far

antiquity of the Vedic Literature. The statement is from the ancient Taittireeya-Upanishad and his commentary on it expressed with clarity that the Space (*Aakaash)* in the Vedas is a real entity and is one of the most important participants in the creation of the universe. The English translation of the relevant first part of the Taittireeya Upanishad statement and Swami Dayanand's commentary on it are presented in the following:

*"…..तस्माद्वा एतस्मादात्मन आकाशः सम्भूतः"।*

("*tasmadva etasmaadaatman aakaashah sambhutah*").

The commentary on this Taittireeya Upanishad's statement by Swami Dayanand is in Hindi language. This author has translated his commentary from Hindi to English as in the following:

> "*The aakaash-avkaash is a real causal substance (entity) spread out ubiquitously and its collection as a whole makes it Aakaash (Space-entity) the existence of which is revealed from the Creator and the creation (Nature).*"

He elaborates further on the Taittireeya statement asking a rhetoric question,

> *"…the reality is that the Aakaash* (Space-entity) *is not a created entity, because without a pre-existence of it where can Nature and its atoms stay…"?*

This statement shows that the concept of Space being an entity is extremely ancient. Taittireeya Upanishad was written in the far antiquity from the time Swami Dayanand wrote the book Satyarth Prakash and the concept of *Aakaash* (Space-entity) came into Taittireeya Upanishad from the Vedas before that. All Upanishads have derived their principles from the Vedas. The fact that the Space is an entity, pre-existing this creation, has been consistently stated and discussed in Brahmanas, Smritis, Shastras and the rest of the Vedic Literature and this is well before the development of thought on this subject in the Western philosophy and science. The earlier Western philosophers and the scientists continued to think that Space was an empty place called the 'sky' where all things and cosmos stayed and functioned and that it had no property of its own and therefore had no influence on the things that existed in it. The same thinking prevailed for

the Time-entity. It is since a few centuries ago that the thinking about Time and Space started to change and the concepts are ultimately brought out in the open by the space-time continuum of General Relativity put forward in mathematical formulations of Einstein. The fact is that the concepts of Time and Space are not the recent adjunct to the developing physics of modern times; they are an endowment of the past. A large number of synonyms of *Aaakaash*, the Space-entity that this author has collected out of many more in the Vedas are also an endowment of the Vedas.

The ancient book of commentary on YajurVeda is the Shatpath Brahmana. A statement in this Brahmana on *Antariksh* (Space-entity), a synonym for *Aakaash*, states clearly what exactly the *Antariksh* is. The transliteration of the Shatpath Brahmana statement reads thus –

> "*…yatha heveyam pratishthavirasminloke prathivyvamu hevesha pratishthavirmushmin lokaha idamantariksham. Sa yadiha sannmum lokam na pashati tasmadahuha paroakshmsau loka iti*." (Shatpath Brahmana, 11/1/6/22),

**Its translation is**:

> "*…just as the Earth is the support of all substances in this region of the universe, likewise the Antariksh is in that region of the universe. People sitting here are not able to see that region of space and this is the reason why they call that region as paroksh*. (Shatpath Brahmana, 11/1/6/22).

The reference here was for the deep-space beyond observation. Its simile with the Earth is to explain that just as the Earth is the support of all terrestrial objects that one can visualize and experience, the *Antariksh* is the support of all objects even though they are faraway in deep space 'beyond observation' (*paroksh*). Therefore, the concept of Space being an entity and its function being the support for cosmos is right out of the Vedas, the oldest books in human history. The Space has been understood by the ancient Aryans of India for what it is.

The concept of the Space being an entity is difficult to grasp because one cannot see it, smell, taste, touch it or cut a piece of it to study later. One is not able to put a measuring tape directly on it or experiment on it like we

are able to on a piece of matter from the Nature-entity. The best one can do with the Space-entity is to measure the distance between two points and ascertain that the two points are separated in space by a given measure. But the Space is not confined in a plane, it spreads out in all three dimensions. The space can also be measured in three dimensions that is trapped by the volume of the object. But the object is not able to core-out its own trapped space from the rest of the Space outside it. Space by itself is not available to help prove its own existence. Sensing of Space-entity, as well as of Time-entity, by our senses is not possible because they do not interact with our senses. Now even the modern science says that these entities have real existence. This is what the Vedas have said since the far antiquity.

As mentioned before, the Space-entity like the other important entities of the creation has large number of synonyms in the Vedas, each reflecting Space-entity's specific function, its coverage of a specific region of the universe and its properties. Again, this exhibits the richness of the Sanskrit language. Just as a person in a small corner of a room of a big house is also said to be in that house, the term *antariksh* in some Vedic references is used for the specific space in which the solar system is housed. Just as the term 'earth' is used for the matter (soil) that forms the planet Earth, the space in a smaller region is addressed as *antariksh*. This author has come across in the Vedic Literature a large number of synonyms of *Aakaash* (Space-entity), including those listed in the Nighantu part of Yask Rishi's book of Nirukt Shastra (2/3/1). The 22 of these are listed in the Table 5.6. The meanings of a few most commonly used words for *Aakaash* are included in this table.

Nirukt, the ancient Vedic treasure of philology and etymology together, takes up words that occur in Veda mantras and provides interpretation of their meaning, giving the root of the word formation that leads to the right translation of a mantra. Of the 22 names of *Aakaash*-entity that this author has presented in Table 5.6, Nirukt has provided the interpretation of the 5$^{th}$, 13$^{th}$ and the 15$^{th}$ terms, the *Antariksham* (or *Antariksh*), Naakah and *Pushkaram* - all synonyms for the same Space-entity. The Nirukt states:

> "*Antariksham is formed of antara+kshaantam* (inter-space + spreadout) *and because it exists between the Earth and the Dyu*, *or because it is antar+akshaya* (interspersed+non-decaying) *and exists within living body without suffering from*

*change like the change and decay in Earth and matter"*. (Nirukt, 2/3/1; translation from Sanskrit to English).

The term Dyu in the statement stands for the brilliant region of space where the Sun's abode is.

Thus without a doubt, the Nirukt defines the Space to be an all-pervading physical real entity. The commentators on Nirukt have described *Aakaash* or *Antariksh* to be *mahaanavayava* (*mahaan+unavayava*). This conjoined word of two parts stands for an entity that is *mahaan* (great) and *unavayava* (without limbs or branches, or parts or shape or form). All substances in the creation are avyavi – having parts or limbs in them. A piece of iron in the shape of a sphere is observed to have no limbs in it but in Vedic philosophy it is an *avayavi* with limbs because it is made up of individual iron atoms, which are its limbs.

The *Aakaash* (Space-entity) addressed by the adjective of *mahaanavayava*, "great without limbs" puts it altogether in a different category not recognized yet in the contemporary Big Bang Hypothesis, that it is a one single entity, conterminous without a structure formed by quanta. It is a continuum in 3-D and is a great entity.

The important deduction here is that the Space-entity is not a quantized entity like the Nature-entity. This excludes a modern thought by some cosmologists who think that the Space has its own corpuscles.

The word *antariksham* for *Aakaash* (Space-entity) has come in Veda mantras a large number of times (e.g. RigVeda 1/110/6, 10/90/14, ....). The RigVeda mantra (10/90/14) states that when the creation commences the *Antariksham* arises from the *naabhi* (naval) of the Creator. The naval here represents the centre of activity. This gives Space-entity yet another synonym of *Nabha* in item (12) in the Table 5.6.

**Table 5.6: The 22 Synonyms of the Vedic Space-entity**

| | Space-entity | Comment |
|---|---|---|
| **1** | **Aakaasham** | **creates place for objects** |

| | | |
|---|---|---|
| **2** | **Aapah** | **pervading in universe like *aapah*** |
| **3** | **Adhvaram** | **Nighantu, 19, in Nirukt ( 2/1/3/1). One that accommodates without getting injured (without getting altered)** |
| **4** | **Ambaram** | **place for aapah the material cause for creation** |
| **5** | **Antariksham** | **space between and within cosmos. Ref: RigVeda 1/110/6, 10/90/14, 10/121/5, AtharvaVeda, 10/7/(several mantras).** |
| **6** | **Arnava** | **The sea of space, many mantras** |
| **7** | **Barhih** | **Fire, whose form minute like energy** |
| **8** | **Bhuhuh** | **that with characteristics of supporting the substances** |
| **9** | **Bireet** | **Place of fear for it is an entity unsupported by anything-else or the place for *vayansi* the objects that fly - animate and inanimate (Nirukt, 5/4/9)** |
| **10** | **Dhanv** | **vast and spread out like a desert** |
| **11** | **Kuru** | **A place of action, vast farm for cultivation and growth, YajurVeda (23/56)** |
| **12** | **Nabha** | **rises from the naabhi (naval, centre) of Purush (Rig. 10/90/14)** |
| **13** | **Naakah** | **A container or a holder, AtharvaVeda (10/7/43)** |
| **14** | **Prithvi** | **property to hold substances like Earth** |

| | | |
|---|---|---|
| **15** | **Pushkaram** | **Pushkaram antariksham- Care provider for all in existence in it, Rig.6/16/13; Nirukt, 5/3/2/2, Nighantu 48.** |
| **16** | **Sagarah** | **deep and extended like a sea** |
| **17** | **Samudrah** | **the sea of cosmos** |
| **18** | **Shenah** | **all-pervading, Rig.(10/144/4-5)** |
| **19** | **Svayambhu** | **being in existence by itself, no cause creates it** |
| **20** | **Vimanah** | **the place for objects to move and fly. Rig 10/123/1+many more** |
| **21** | **Viyat** | **which is seen spread in all directions containing different forms of objects (Nirukt, 2/1/3/1)** |
| **22** | **Vyom** | **Ubiquitous encompassing all matter of the universe by providing place for it, RigVeda (10/129/1)** |

The other meaning of *Nabha* is '*one that expands*'. The most common Sanskrit term for the Space-entity is *Aakaash* and it is *antariksh* (YajurVeda, 31/13) in applied science thought where the word *antariksh* means "*the space between the cosmological bodies*".

## Space the Flower of Creation

The job of science is to present dry facts about a phenomenon without worrying about its beauty which is in the eye of the beholder'! Physics/cosmology has ventured upon hypothesizing the nature of the Space-entity whereas the facts about its true nature still remain to be ascertained. As mentioned earlier, a cosmologist uses Space with Time to explain the nature of the physical phenomena of the universe but without a clue of Space's basic nature – is it a continuum or made up of tiny corpuscles? A modern cosmologist would say that Space took birth in the space-time singularity of Big Bang and expanded with the universe later in

time, not knowing with certainty if it pre-existed holding the universe within its shrunken status. The physical nature of Space remains a mystery even for the advanced modern cosmology.

Because Space-entity is invisible, the beauty that is seen all around us in nature is not perceived as the beauty of the Space-entity (*Antariksh-tatva*); rather, the Space-entity is seen as the enabler of the beauty of the Nature-entity (*Prakriti-tatva*). The Vedic cosmology presents a root-derived term for *Antariksh* (Space) that delineates its properties and also reveals the unseen beauty of the Space-entity itself. This term for Space is '*pushkaram*' listed as item (15) in the Table 5.6. The term *pushkaram* for Space by itself is a meaningful science term that reveals the physical properties of the Space-entity but '*pushkaram*' is also a unique metaphor to manifest the beauty of the Space-entity. The term '*pushkaram*' is analyzed in the following and the reader would appreciate the fact that the Vedic cosmology presents the characteristics of the Space-entity with dexterity that have not been imagined as yet in modern times.

The Nirukt (5/3/2/2) provides the etymology for the term *pushkaram* where it states that *pushkaram* is *antariksham* the Space-entity. The term *pushkaram* is derived from a single *dhatu* (root) and is a multi-meaning term. The root for the word formation that leads to the term *pushkaram* yields several related meanings and functions associated with it. These meanings of *pushkaram* or *pushkar* are presented below in the characteristic style of Rishi Yask's Nirukt:

- *Space is pushkar because it does poshan of all substances of the universe, animate and inanimate, by benignly providing space for their existence*.

The term *poshan* stands for '*provides care*'. The virtue of benignancy in the Space-entity is emphasized by the book of Nirukt because a care-provider in the true sense is a beneficent giver without expecting anything in return. The Space-entity in Nirukt's definition being a cradle for all substances includes matter and energy. Therefore, Nirukt's definition of Space does not permit Space to be formed out of matter and energy. The Vedic Space-entity therefore is not made of matter or of matter in energy form. In the logic of the word-formation in Vedic system if the Space

consumed matter of the universe for its own existence, the Space could not be termed as a benignant provider. This is why the *Antariksh* (*Pushkaram*), the Space-entity of the Vedas, is said to be an entity which is not an 'effect' of a 'cause'. The Space-entity of the Vedas is an eternal entity in the fellowship of the Time-entity and the other three eternal entities that were discussed earlier. The Nirukt continues listing other virtues of *Pushkar* (Space-entity).

- *Space is pushkar because it is pujakaram; it adorns in it all devas (fundamental properties and functions of Nature) for invocation* (not living-beings).

It was mentioned in Chapter 2 and discussed in Chapter 8 in Volume 2 that the Vedic *devas* are 'first-born' fundamental properties/systems/energy-forms that enable the creation and sustain it through the life of the universe. *Devas* are the Nature and the Nature is the *devas* that are held safely within *pushkar* the Space.

- *Space is pushkar because it rises above matter like a lotus flower rising out of mud* (not made of matter)*, yet remaining beautiful and unblemished.*

A lotus flower is known for its beauty and its detachment from mud in spite of its association with it. In a Vedic spiritual discourse a lotus flower is usually cited as an example for one that exists in its efflorescent beauty without having attachment to its material surroundings: the mud and water. The Space is *pushkar* because it holds matter without getting attached to it. Therefore, the Space-entity's adjective is *pushkar*!

- *Space is pushkar because it is vapushkar; its character and form are not affected even when utilized.*

This property of Space primarily differentiates it from matter. To understand this, let us consider the utility of matter and the utility of Space. Take for instance two solid spheres of the same diameter, one made of iron

with the density of 7.9 grams per centimeter cube and the other made of aluminum with the density of 2.7 grams per centimeter cube. The physical nature (composition) of the Space-entity according to the Vedas being minute, it pervades uniformly through both spheres of differing densities. The Space remains unaltered when inside the matter or outside of it or inside a dense material or inside a light material. This property of Space is *vapushkar*.

The *vapushkar* property of Space stipulates that reshaping of substances does not reshape the space occupied by the material objects embedded in it. The Space occupied by an object at a given place is not available to another object next to it but the Space is not consumed by the object and it becomes available as soon as the object moves to occupy another Space.

Let us now move from mechanics to pure physics where a modern cosmologist deals with Space. A cosmologist is often found saying or writing that 'in space-time continuum the time affects space and vice-versa'. In view of the Vedic concept of Space that Rishi Yask elaborated upon in his ancient Nirukt Sutra, the cosmologist should be given credit for being half correct. This is because there is no deterministic physics mechanism in which time changes into space or space into time, or the space ties to time or time raps around space. May be the mathematics plays the role in creating the space-time continuum but it cannot be proven that physics or chemistry does. What the modern cosmologist in fact is talking about is what actually is happening in his mathematical equation that he has set up, wherein the time and space are conjoined as two mathematical operators. The fact is that the Time and Space being two different eternal entities in the universe are not even capable of being conjoined with each other or with something else. A cosmologist in his mathematical construct (a gift from Einstein), imagining that one affects the other is unwittingly violating the *vapushkar* nature of the Space-entity.

The theoretical and observed curving of light rays passing close to massive bodies that Einstein explained on the basis of the Space developing excessive curvature, may not even be due to the curvature in Space. It could just be due to the gravitational effect on the invisible background *aappah* field in the vicinity of the massive body as delineated in Figure 9.11 in Chapter 9 under the sub-heading "Curved Space near Massive Bodies has a Different Meaning". The space becoming heavily curved in one region

means becoming concentrated in that region and remaining rarified in rest of the void of the universe may cause a problem – it would create uneven islands of space that would move with massive bodies leading towards chaos. The *vapushkar* property dictates that the matter is embedded in Space and the Space does not alter it.

To understand the in-depth meaning of the *vapushkar* attribute of the Space-entity, let us conduct an imaginary experiment.

Consider a hollow steel sphere with wall thickness of say 2 millimeters with the same air inside it and outside. Now create a perfect vacuum in the sphere by sucking the last air molecule out and ask- what is left inside the sphere? The expected answer is – 'nothing'. This answer according to the Vedic thinking is invalid because it violates the Vedic definition of *Aakaash*. In the Vedic thinking, the sphere is devoid of air but there is still the presence of a real entity in the void of the sphere, the *Aakaash*, the Space-entity of modern cosmology. This entity was still conterminous in the entire volume of the sphere. The Space at any point inside the sphere was exactly the same as inside the 2 mm thick steel wall and outside the sphere. The wall with any thickness made even with the heaviest metal does not create discontinuity in Space. This is what was said by the Vedic *rishi* in a single Sanskrit term – *vapushkar.*

The nature of Space is unaffected inside and outside of the sphere when it is stationary or in motion. For example when a pitcher throws a baseball the Space that the ball occupies near the pitcher does not travel with the ball or the ball does not create and tunnel in Space as it travels between the pitcher and the batter, it leaves the space behind that it occupied before and occupies new space at each point on its path. In other words the space was always inside the ball but was not being captured by the ball or consumed by it. This is the meaning of the Vedic term *vapushkar*, which basically tells us that '*the Aakaash keeps its form even when in use by a substance of any form*'. Modern cosmologists use the Space in their field equations and deal with it mechanically but they have possibly not contemplated on its properties that have been pointed out by the Vedas. The *vapushkar* is inherent to *Aakaash* and *Aakaash* is an eternal entity not requiring evolution. The ancient term, *vapushkar*, representing an important attribute of the Space-entity, is unique to the Vedic physics.

In the Vedic concept of creation, the preexistence of the two entities, Space and Time, is a necessity. They are to be available at the onset of the

creation when the first fundamental particle of matter takes birth in the creation or as Swami Dayanand Sarasvati had put it rhetorically – "… *without its* (Space-entity) *pre-existence where could the Prakriti* (Nature) *with its paramanus* (atoms) *stay....".* The Space has to be subtler than the smallest fundamental particle of matter because only then it can permeate inside each matter particle to hold it. Additionally, the Space has to be available beyond the edge of the universe to hold the entire matter and energy of the universe to serve as an overall container of the universe. It also has to have the property of stretching without snapping to accommodate the expansion of the universe. If it did not have these attributes, the matter would interact with it, capture it, enslave it, consume it, distort it or displace it ensuing chaos. This is how the Space is viewed in the Vedic philosophy. Since the Space-entity and the Time-entity are the eternal entities, they are non-provable; however, the modern cosmology is obliged to prove them because the Big Bang Hypothesis created them only 13.8 BY ago.

Some cosmologists have asserted that the time in Einstein's space-time continuum is affected by the space and vice versa. This assertion is not of great value if it happens in a field equation but not in the reality of Nature. If the space and time are variables in an equation a mathematical change in one variable would change the other variables.

An important outcome of general relativity is that the space is curved in the vicinity of heavy celestial bodies; heavier the body greater the curvature in Space. This outcome enabled improvement over Newtonian classical mechanics and explained better the motion of celestial objects. The observed bending of light rays towards the massive gravitating bodies in space is interpreted as the proof of this phenomenon. As mentioned above and discussed in detail in Chapter 9, this can be explained on the basis of the ubiquitous *aapah*-field in the so-called vacuum of space. In Vedic thought the background *aapah*-field also serves as the viscosity of Space serving as the velocity moderator for all objects including the photons in light beams. It is this viscosity that sets the speed of light at $3.0 \times 10^8$ meters per second. Under this reference frame the fundamental matter particles smaller than the photons of light would have speeds higher than the speed of light.

The attribute of *vapushkar* in the Space-entity could be considered as a limited case of the relativistic mechanics; however, in the Vedic concept the

Space is not consumed or altered by Time or matter or by gravitation. This is not to say that the entire space of the universe is not curved. Even if the *vapushkar* attribute of Space is seen valid in a limited regime, the recognition of the property of *vapushkar* in the Space-entity by the Vedic *rishis* indicates tremendous insight into an entity that continues to be as abstract in the minds of modern cosmologists as it was in the Vedic science and philosophy millennia ago.

- *Space is pushkar because it has the property of pushpate, one that swells.*

The word *pushpate* (*pushp*) is derived from the root that yields the '*action of swelling*'. The corresponding commonly used noun for *pushp* is flower because it is the result of swelling. This brings us to the relationship between the Space-entity, the *pushkar* and *pushp,* the flower.

The Vedic mantras credit the Creator for spreading the Space and the universe and the embedded celestial objects with it (e.g. RigVeda 10/56/5). This mantra is fully elaborated upon in Chapter 9 under the sub-heading of "**Expanding Universe - a Vedic Discovery Eons Ago**" in Volume 2. Even if the Creator is taken out of the equation, the residuum of this mantra still emphasizes that the universe has expanded with celestial objects going apart from each other, as in the part mantra - "*…Thus the diverse population of cosmos of the universe spread out in togetherness bound by Nature's rule"*. The Vedic principle that the Space-entity has the property of *pushpate* (one that swells) thus, in any shape or form, is no different from what now is the part of the observational astronomy and therefore a part of the Big Bang Hypothesis; that the universe is expanding.

The simile of the flower and Space was briefly discussed in Chapter 1 exhibiting the *pushpate* property of the flower and the Space.

*Pushkar* the Space-entity of the Vedas starts as a *tuchchhayen* (minute/diminutively small) as in the RigVeda mantra (RigVeda, 10/129/3), to be discussed in Vedic Creation Principle (Chapter 6), when the Nature in its dissolved phase is in non-descript matter form. Here a bud of course is only a metaphor because the initial size of the universe in the Vedic thought is diminutively small relative to the size of the universe but not small like a bud. The *pushkar* property is assigned to the Space entity and not to the

matter of the universe. The *Prakriti* (Nature-entity) and *Aakaash* (Space-entity) for the Vedas are two distinct eternal entities. Based on Vedic references it will also be discussed that in the Vedic creation of the universe, the Nature starts as an ovate of matter and flattens out like a flower creating the cosmos. The Space assuming the shape of the Nature continues to swell along with the matter of the universe. The Space, otherwise a dry subject of physics, is expressed in the Veda in terms of the indescribable beauty and action of a flower; a unique definition of an invisible entity!

The Vedic delineation of expansion of Space through the metaphor of a flower (*pushp*) is remarkably simple, unique in modern perspective and close to the reality of the expanding universe. There are several fundamental dissimilarities in the two principles. The universe in a Big Bang of course starts from a dimensionless space-time singularity and in the case of a flower it starts from an invisible to the eye first specific plant cell that multiplies creating differing molecules to create later observed diversity within the flower. A flower certainly is not 'out of nothing'. Its cells multiply or replicate owing to the *eekshana* desire in the living plant. The Vedic wisdom here is admirable that brings a complex subject for common person to grasp. A flower represents beauty. The flower metaphor for Space creates a thought - if one had the ability to see the Space-entity and its expansion, it could even be a beautiful thing to observe. In the following are presented two successive AtharvaVeda mantras that illustrate yet another important character of *Antariksh,* the Space-entity.

# Antariksh - the Vedic Space is Curved

*Antariksh* (Space) of a substance in Vedic expression is that substance's container, such that it holds the substance by pervading through the substance itself. In this perspective the *Antariksh* of that substance is in the same shape as the substance. The Earth's personalized *Antariksh* is spherical because the Earth is spherical and the solar system's *Antariksh* is in the shape of the solar system shaped like a discus, with Earth's *Antariksh* within it and part of it. Likewise, the *Antariksh* of the universe by reduction is in the shape of the universe itself which in the Vedic concept is a rotating wheel-shaped system of galaxies with a central axis of rotation (discussed in Chapter 9). A nook of the universe may be in so-called vacuum devoid of matter, but it is not devoid of two things, the *Antariksh* (Space-entity) and the ubiquitous undetectable *aapah* field, latter serving as the viscosity of space to regulate speed of substances including photons. In what shape the universe is and therefore in what shape the Space-entity holding it is, will be discussed further in the Volume 2 of this book.

Asking a question and answering it subsequently or later in another *sukta* (hymn) is a style in the Vedas and in the post-Veda literature. Following are two mantras, one with a question and the next with the answer. The question is primarily in the realm of cosmology and the answer is within the Vedic cosmological frame work. In the first mantra the question relates to three objects: *bhumi* the Earth, *dyau* (synonymous with *dyu*) defined as the brilliant region of space where the Sun resides and *Antariksh* the Space.

The question:

केनेयं भूमिर्विहिता केन द्यौरुत्तरा हिता ।
केनेदमूर्ध्वं तिर्यक् चान्तरिक्षं व्यचो हितम् ॥

(AtharvaVeda, 10/2/24)

**Transliteration**: "*Keneyam bhumir-vihita ken dyaur-uttara hita. Kenedam-urdhvam,* ***teeryak*** *cha-* ***antariksham vyacho*** *hitam*".

**Mantra Translation**:

"*Who has created and prepared well the Bhumi* (Earth), *who has placed the Dyau* (illuminated region, the abode of the Sun) *high up and who has established the Antariksh (****Space-***

***entity**) aloft which is vast and **spread-out curved like the path of an arrow**?"* (AtharvaVeda, 10/2/24)

The answer:

ब्रह्मणा भूमिर्विहिता ब्रह्म द्यौरुत्तरा हिता ।
ब्रह्मेदमूर्ध्वं तिर्यक् चान्तरिक्षं व्यचो हितम् ॥
(AtharvaVeda, 10/2/25)

**Transliteration:**

"*Brahmna bhumir-vihita, Brahmn dyaur-uttara hita.*
*Brahmedmurdhvam, **teeryak** cha-**antariksham vyacho** hitam*".

**Mantra Translation:**

*"Brahmn the Creator has created and prepared well the Earth, Dyau the illumine region has been placed high up and Brahmn has established the **spread-out curved-space**."* (AtharvaVeda, 10/2/25)

The Veda could have stated the above thought purely for spiritual gain as it does throughout the Vedas by stating that Brahmn the Almighty is to be worshipped because He has created the Earth, the abode of the Sun and the illuminated space. But by talking about a demarcation between the Earth and *Dyu* and by defining the character of Space to be curved like the path of an arrow, the Veda here is clearly imparting knowledge than advocating spirituality. The basic intent in these mantras is to impart knowledge by drawing distinction between the three major entities, the well-crafted Earth, the brilliant cosmos and the *Antariksh* (Space-entity) with the specific feature of being vast, *spread with curvature* in it.

It is important to note the two properties associated with the Space-entity cited in the mantras: it is *curved like the path of an arrow* and it is *spread-out* well beyond the Earth and the solar system. A third property of the Space-entity stated by another RigVeda mantra (10/129/3), to be discussed in Chapter 6 under the Vedic Creation Principle, is the initial confinement of the Space-entity in a small locale during the Nature-entity's *pralaya*-phase (dissolution). The adjective used by the RigVeda for that

initial state is *tuchchhayen–aabhu*, means the diminutive Nature. The action of Nature spreading out in all directions at the onset of creation is also stated there in the successive mantras. This would make the Vedic-defined Space a flexible entity.

The physics contained in the तिर्यक् *(teeryak)* property of Space, emboldened in the transliterations of both mantras need some elaboration. In the compound word *teeryak = teerya+k*, the first word means 'an arrow' which is a small physical object. The *k* suffix to *teerya* transforms the word into a pure adjective yielding – *like the path of an arrow*. Therefore the mantras are not talking about an arrow itself; rather they are talking about the property of an arrow, that its path is curved. The mantras' contention therefore is that the *Antariksham* (Space) is curved. Also stated in the mantras is another property of *Antariksh*, the व्यच: (*vyachah*). The term *vyachah* stands for '*vast and spread-out'*. Thus the Space-entity is not represented by an arrow itself or a linear curve formed by the path of an arrow, instead the *Antariksh* according to the Vedas is *curved*, *vast and spread-out*.

There are several other Veda mantras that are consistent with the fact that the Space-entity is an independent entity. The curved Space of the Vedas may be different from what Einstein conceptualized in his space-time continuum. However, the concept of space being curved started in the ancient Vedas. Some Vedic scholars have even remarked that Albert Einstein, who used to read Vedic Literature, may have gotten the basic idea of curved space from the Vedas! Many scholars translate *Aakaash* to be the 'nothingness'. The Vedas and Shastras (all 6 books of philosophy) and the rest of the ancient Vedic Literature define the *Aakaash* as a real entity, the Space-entity, which also is the basis for the modern cosmology.

In addition to discussing gravitation of the Earth, the Vaisheshik Darshan of Rishi Kanaad has dealt with *Aakaash-tatva* (Space-entity) assigning yet another property to the Space-entity. Just as Rishi Kanaad enumerated the *lingas* (defining signs or characteristics) of the Time-entity that were listed earlier in this chapter under Time-entity, he has stated in the *sutra* (2/1/20) the *lingas* of *Aakaash* as well:

निष्क्रम्णं प्रवेशनमित्याकास्य लिङ्गम । (Vaisheshik, 2/1/20)

**Transliteration**: "*nishkramnam praveshanmityaakaasya lingam*".

**Sutra Translation**:

*"The property permitting the 'exit from and entry into' is the defining sign of the Aakaash"* (Vaisheshik, 2/1/20).

The statement, '*exit from and entry into'* sounds quite simple because one can enter into and exit from a medium other than *Aakaash* (Space) as well, examples being air and water. While on Earth a person is already entered into air and can exit it riding a rocket out of the Earth's environment. To enter water one can jump into a swimming pool and exit from it too. If the *sutra* was that simple the *lingam* (defining sign) of air and water would be the same as that of the Space. This would render Rishi Kanaad's *sutra* fallacious because a *lingam* by definition is uniquely specific to a specific substance. Rishi Kanaad is a giant of Vedic philosophy. Considering how masterfully he framed the *sutras* on gravitation of the Earth that were cited in Chapter 1 and discussed further in Chapter 11, Rishi Kanaad's *sutra* (2/1/20) on the *lingam* of Space-entity has a deep meaning regarding the '*exit from and entry into'*.

The status of the pool-water changes when someone enters a swimming pool. The water equivalent to the volume of the body of the person is displaced. The same is true for air which is displaced when a body enters in it. The Space on the other hand does not get displaced when a substance '*exit from and entry into'* it. The implication of Rishi Kanaad's *sutra* is that when things enter into the Space-entity and exit from it, the physical state of the Space-entity neither changes nor is it consumed in the process. It permits the action of exit and entry for all substances without the substance or the Space being affected.

The Vedas have recognized the Space-entity with another adjective, the *vibhu*. The term *vibhu* is for an entity that is all-pervading through the universe without a break in it and without having branches and limbs which is the same as Nirukt's definition of *Antariksh* (*Aakaash*). In Rishi Kanaad's Vaisheshik Darshan, 8 sutras later (Vaisheshik, 2/1/29-31) the Space is considered to be a single and separate entity by itself.

Rishi Kanaad has also associated *linga* to some important substantive objects as well. In the Vaisheshik *sutra* (1/2/6) he states that 'action' is the *linga* of substantive objects having shape and discontinuity in them (made of separate atoms). He emphasizes the contrast between substances

generating action (karma) and the three non-substantive entities: Direction, Time and Space as,

*"Direction, Time and Space, having their dharma incongruous with the substances having dharma of karma (action), are action-devoid entities"* (Vaisheshik, 5/2/21).

This means that all actions (karma) seen in Nature are imperatives of Nature and not of Direction, Time and Space. This also means that the inherent property of 'action' in matter (Nature) is matter's *dharma*. The *dharma* in context of an inert substance is substance's expected inherent property that it displays on interacting with other substances. For example it is seed's action (dharma/karma) to sprout. In the context of living being, a person's *dharma* is to follow the rules of the society. In general, matter's *dharma* is to follow Nature's physical laws that the physicists have rediscovered in recent times. As we know that the gravity creates most observable karma (actions) in the form of motions of objects of the universe.

Newton in his third law of motion stated that '*to every action (karma) there is equal and opposite reaction (karma)*'. What Rishi Kanaad established eons ago in his *sutra* on action is what actually creates the action itself. Knowing that there are other pervading entities in the universe taking part in a complex manner Rishi Kanaad emphasized that all actions (karma) emanate from matter/energy (Nature = matter +energy) and not due to other entities. Then a natural question is – what is the big deal in Rishi Kanaad's *sutra* because all things happen in Nature anyway including action? The big deal is in the first part of Rishi Kanaad's concise sutra where he affirmatively states that the property of action is NOT PRESENT in or created by the three real entities - Direction, Time and Space, which are also present in the universe along with the matter. In other words, the *dharma* of each of these three entities is different from the dharma of Nature. Coming back to the context of this section, the Space-entity according to the Vedas is an action-less entity.

One other adjective that Vaisheshik Darshan (7/1/22) has associated with the Space-entity is **विभव** (*vibhav*). The adjective *vibhav* means '*to be interactive with all substances at the same time*'. This means that it is pervading through all substances at all times. The Space-entity with its all-

pervading nature is an integral part of the Vedic science and cosmology because in the Vedic principles it is said to be the binding agent of matter during matter's indefinable state (*Asata*) in the non-creation phase and also in the definable state (*Sata*) of matter in creation phase.

Rishi Kanaad presents more *sutra* formulations to differentiate *Aakaash* from the other four elements of philosophy *Vaayu, Agni, Jal* and *Prithvi* (Air, Energy, Water and Earth). He isolates a basic property of *Aakaash* which also serves as its defining sign (*linga*). It is *shabd*. The properties of smell, warmth, taste and shape are absent in Aakaash. The ordinary meaning of the Sanskrit term *shabd* is 'sound' or an 'uttered word'. The deeper meaning of the term *shabd* is 'vibration'. The vibrations being action (karma), they can be produced only by matter but can be carried forward owing to the continuity of Space between the discontinuities of atoms of intervening matter. This means that matter could create vibrations but could not transmit or sustain them in the absence of *Aakaash*.

Space-entity is also termed as *Svayambhu* ($17^{th}$ term in the Table 5.6). The *Svayambhu* is the term for an entity that has its existence by itself and is not an effect of a cause. For an entity to be all-pervading like Space, it has to be more minute than the fine-structure of all substances immersed in it including the smallest fundamental particle and energy form of matter. In the Vedic definition, the Space is minuter than the smallest particle of matter, be it a quark or anything smaller particle than that, because it pervades inside such particles as well. For the Space-entity to be *Svayambhu* it could be interactive with all substances at all times (*vibhav*) but non-reactive with substances, making Space a no-decaying and non-consumable entity. This property of Space is made clear in Bhagvadgita as well, wherein Yogiraj Krishn preached to Prince Arjun about the nature of the Soul-entity. The Bhagvadgita's message to Arjun just before the coronation of Arjun's older brother Prince Yudhishthir in 3140 BCE in Hastinapur (ancient capital near Delhi), is not as old as the Vaisheshik Darshan and the Vedas. Nevertheless the Bhagvadgita establishes the consistency in Vedic thought and perspective on the concept of Space as thought by Krishn and all other *rishis* before him. In Krishn's message to Arjun the emphasis was on the nature of the Soul-entity where the Space was only an example. The property of Space comes through in his message as a byproduct of knowledge but the concept of Space in Krishn's message

is no different from the one in Vaisheshik's *sutra* (7/1/22). Krishn's message is:

यथा सर्वगतं[1] सौक्ष्म्यादाकाशं नोपलिप्यते[2] ।
सर्वत्रावस्थितो देहे तथात्मा नोपलिप्यते ॥

(Bhagvadgita, 13/32)

**Transliteration:** "*Yatha sarvagatam[1] saukshmyaadaakaasham nopalipyate[2] ।Sarvatraavasthito dehe yathaatma nopalipyate"* ॥

**Shloka Translation:**

*"Just as the all-pervading Aakaash (Space), owing to its minute nature, does not attach to any object in it, the soul-entity in the living-being also does not attach to the matter of the physical body*."

Bhagvadgita (13/32).

Brief commentary on this was included in Chapter 1.

It is clear from this statement that the *Aakash* (Space) for Krishn 5,000 years ago was a real entity. Krishn in this *shloka* of Bhagvadgita invokes the Space-entity to illustrate a common property between the Soul-entity and the Space-entity. This common property is expressed in the term नोपलिप्यते[2] (*no-api-lipyate* = non-interaction or non-attachment) with matter. The deeper sense of the *shloka* is that the soul-entity is non-consumable in chemical and physical processes of the physical body, where it lives unattached like the Space-entity that holds all substances of the universe yet remains unattached with the universe and all substances in it and remains unutilized by substances embedded in it. The bonus of the *shloka* is the mention made by Krishn of yet another property of Space, this property being सर्वगतं[1] (*sarvagatam*), meaning '*one that has gone into all*'. This means that the Space-entity is an all-pervading conterminous entity. An excellent definition of the Space-entity!

## The Space in Vedic Metrology

A primary measurement of space is to measure shortest distance between two points separated in space. This is the same as a measurement

on a straight line. Linear measurement is of great importance in all societies. The standard for measurement in Vedic civilization was a *hasta* (about 44 cm). Longer rope or a chain was calibrated by the smaller standard of length measurement. Markers and milestones were installed by societies to avoid repeated effort in measuring distances between different towns. A yard or a meter became most common measures of the present society.

The Vedic metrology standards for measuring space are briefly reviewed indicating that the scholarly of the society had developed the fundamentals for space metrology from the knowledge provided by the Vedas.

**Case of the word mitra →metre (meter)**

This section is to delineate how some of the fundamentals having origin in the Vedas became practices in the Vedic society. The unit of length measurement in metric system is one such example. It begins from the word *mitra* the common meaning of which is 'a friend'. The word appears in several Veda mantras and has deeper meaning as well. While interpreting a RigVeda mantra (1/2/7), the 19th century Sanskrit scholar and the Vedic writer in English, Pandit Gurudatta Vidhyarthi, quoted several times in Chapter 4, wrote thus:

> *"The first literal meaning of mitra is the measurer. The name is given to a substance that stands, as it were, as a measure or as a standard substance. It is the measurer of density, or of value, otherwise known as quantivalence. The word mitra is formed by adding unaadi suffix ka, to the root mi, according to the sutra 'amichimishsibhyah kr', un. 4/164. The meaning is '**minoti manyam karoti mitrah or one that measures or stands as a standard of reference**"* is a *mitra*.

From the same root is reflected the property of *mitra* – '*one that is most sought out and one that sets a standard for measuring up to*'. For its applicability in practical usage the term *mitra* is provided by the RigVeda for developing a standard for measurement. Yet another word from the same root with similar sound is *maatra*, which means 'quantity'. This also conveys the meaning of measurement. The word *maatra* is generally used qualitatively by common people even today in the Vedic society when the

quantity of a substance is referred to. Surprisingly a term sounding similar to the Vedic terms *mitra* and *maatra* is 'metre' in the modern metric system for length measurement. The term 'metre' also fulfils the definition of the Vedic term *mitra* elaborated upon by Pandit Gurudatta Vidhyarthi in the above quotation. One observes from the open literature on Indian Culture that the Vedic society used extended range of length measurement. However, there is little surprise that the Sanskrit words *mitra* or *maatra* have migrated to other languages and civilizations and changed in pronunciation to metre or meter which ended up being used as a unit of length. The subdivision of the unit metre in the Western system also provides ample indication of word migration. The deci-meter and centi-meter are not too far in pronunciation from the original Sanskrit words *dashi* (tenth) and *shati* (hundredth) respectively, having the same meanings as in Sanskrit.

Beyond the measure of a hand was *danda* (stick), *rajju* (rope), multiples of rope-length, *krosha* and finally the measure of *yojan*. *Yojan* has been a common length measurement unit in Vedic Civilization for measuring large distances. The *yojan* for distance is straight from the Veda. In praise of *Rudra*, the hidden form of *Agni* (energy) in living beings including vegitation, the YajurVeda mantra (16/54) thus states poetically -

> *"Situated on Earth are uncountable discrete living systems with Rudra energy working through their respiratory function. The bow of their Rudra energy is stretched out to thousands (innumerable) of yojan".*

Not only the counting in this mantra on living systems implies the discrete nature of living systems, the *Rudra* energy form in them is said to have extended to large distances. Obviously the YajurVeda is talking about the biomass on the Earth and beyond. The *yojan* in this mantra is explicitly a measure of distance. The Shatpath Brahman (9/1/1/28-30) has provided an interpretation of Rudra's bow, stating that wherever one chose to examine, whether in the oceans on Earth or in the oceans of Space, the *Rudra* is present with its bow stretched. The meaning of the Brahmana statement's stretched bow is that the *Rudra* system is energized throughout the universe. When a bow is stretched the stretcher stores energy in the bow which is imparted to an arrow when released. In a typical Vedic Sanskrit expression 'thousand-yojan' generally means thousands of yojan or uncountable units

of distance. A *yojan* in Swami Dayanand Sarasvati's interpretation of the above cited YajurVeda mantra (16/54) is equal to 4 *krosha* which is indisputably accepted by all.

The *krosha* measurement for distance and *krosha* engravings on milestones existed in some regions of India when British started to rule India. Since there was no confusion between the relationship of *krosha* and *yojan* the *yojan* unit of distance remained in limited practice. Disregarding the indigenous culture and language, the foreign rulers also made concentrated effort in imposing their own culture and language. The British were no exception. They introduced English and their system of length measurement. The Aryan units of length measurement including *krosha* and *yojan* were thus replaced by inch, foot, yard, furlong and mile. The British system mainly remained limited to urban India and along the railway system that they established. In the countryside however, the unit of *krosha* continued for all practical purposes till after the government of independent India adopted and implemented the metric system with kilometer replacing the mile. Although there is no confusion between the relationship of *krosha* and *yojan*, the confusion persists in *yojan*'s relationship to the modern units of measurement and the confusion also persists on its value cited in the Sanskrit literature developed in the past a few millennia.

The disagreement on converting a *yojan* into a kilometer stipulates that 1 *yojan* is somewhere between 5 km and 15 km. The majority of traditional Indian scholars have used a figure between 13 km and 16 km for a *yojan*. Religious scholar A. C. Bhaktivedanta Swami Prabhupada of Hare Krishna Mission gives the equivalent length of a *yojan* as 13 km throughout his translations of the Puranic scriptures. This author has accepted the value of 13 km for a *yojan* for a specific reason given under the next section. The reason is discussed in relation to the **speed of light in Vedic literature**.

As mentioned above the conversion factor of 13 km to a *yojan* is going to be the final one for this book. The *yojan* unit of distance is also associated with the spread rate of sunlight scattered from the Earth's atmosphere before sunrise. This is in the first chapter of RigVeda's Usha Hymn.

# The Case of Vedic Usha: the Morning Twilight

RigVeda has devoted two successive *suktas* (hymns), 123rd and 124th, of its first chapter to *Usha Devata* with 13 mantras in each. The Vedic term *usha* is for the phenomenon of the solar illumination on the Earth's surface ahead of the sunrise. In common English language it is morning-twilight. Twilight is the indirect sunlight scattered from the upper layers of the Earth's atmosphere and received on the Earth's surface once in the morning before sunrise and once in the evening after sunset. The RigVeda has assigned the status of *devata* (subject) to *Usha* because of its phenomenal permanence in the creation and for bringing special benefits to the living creation on Earth. *Usha* began with the creation of the solar system and will continue through the creation phase of the universe. Thus, as far as Earth is concerned the phenomenon of *usha* is an invariant of the creation. This is why the RigVeda gave the importance of a *devata* to *Usha*, an inert invariant atmospheric phenomenon. The RigVeda basically deals here with a physics phenomenon.

The emphasis in these *suktas* is on the morning *Usha* because with it begins the 'new dawn' the new onset of activity in the creation on Earth.

From a literary perspective the description of *Usha* in RigVeda is nothing short of a poetic marvel. Brevity restricts this author to present full translation and interpretation of all the relevant mantras. Only some adjectives, physical characteristics and actions credited to this phenomenon in 26 mantras of the two *suktas* are highlighted. From the physics perspective this alone will show the Vedic *rishi*'s interest in observing and studying the phenomenon of atmospheric optics. The two *suktas* on *Usha* phenomenon are credited respectively to two rishis named Deerghtamah Putrah Kakshivan, the son and Deerghtamah Kakshivan, the father.

Among the physics facts associated with *Usha* (morning-twilight) the fact relevant to the space measurement is contained in the RigVeda mantra (1/123/8). It states that *the onset of Usha appears 30 yojan from the place of Sunrise*; which indeed is an observation in atmospheric optics. This is discussed in the following in relation to Earth's geometry.

An atmospheric physicist (this author being one) would tell us that twilight (*Usha*) is a phenomenon in light scattering from the air in atmospheric layers immediately above the surface of the Earth that are laden with aerosol, heavy particulate matter and cloud droplets; all favorable for light scattering in the atmosphere. Depending on the light intensity levels, which depend on the solar angle below horizon, atmospheric physicists divide twilight into three periods, the most bright period closer to sunrise being called the 'civil twilight'. This definition is based on the time just before Sunrise and just after Sunset and is not based on light intensity measurements which would vary considerably depending on the atmospheric condition, latitude of the place and the time of the year. In this period of morning-twilight the objects become visible and the horizon is clearly discernible with unaided eyes. Lacking standardized unit for light level measurement, the observability of the objects and the horizon in the early twilight period remains quite subjective. However, this kind of subjective observability is accepted as scientifically defined 'civic twilight' at the present time.

In the following are listed a limited number of statements from the two *Usha suktas* (1/123, 1/124) of RigVeda which provide some insight into the Vedic poetic description of *Usha,* the twilight phenomenon in atmospheric optics.

- *'Usha lifts the darkness of night and is the banisher of diseases….'* (1/123/1);
- *'Like in all her antecedents the Usha comes as the first beautiful young woman, revealing all objects on the Earth even those that are high...'* (1/123/2);
- *'O Usha you come as Sun's sister and appear as Varun's (Atmospheric water-Air-Ocean system) young daughter…'* (1/123/5),
- *'With your fire-like illumination you illuminate from zenith* (उदाविष्कृण्वन्ति = *udaavishkrinvanti* = revealing from above) *the substances that are otherwise hidden under the cover of darkness...'* (1/123/6),
- *'When the chariot of the Sun arrives, the Sun with its brilliance removes the darkness of the night while you Usha illuminate substances of the creation with your अन्यत् अद्यौत् (anyat adyaut) the secondary illumination, while residing between night and the day that flow in the perennial cycle of Nature…'* (1/123/7),
- *'The onset of Usha appears 30 yojan from the place of sunrise…'*, (1/123/8),
- *'With the adjective of 'the first', O Usha you come without fail bringing with you the pure whiteness of your illumination, a new name for the day…'* (1/123/9),
- *'Usha moves in reverse yet comes back every day following the rule of Nature…'* (1/123/12);
- *'Staying in the lap of your creators (Earth's atmosphere) O Usha you are adorned with sunlight, you spread illumination in the half side of the Earth…'* (1/124/5);
- *'You (Usha) reach every place illuminating even a man fallen into a deep dark pit (dried up deep well)...'* (1/124/7).

These statements, otherwise in the beautiful Sanskrit poetry, no doubt create a vivid description of the twilight phenomenon. Additionally, the mention of associated optical effects and physical measure of its extent lends a touch of physics as well. The last bullet picturizes a man walking in the darkness of night and accidently falls into a deep *andh-koop* (a deep dark-dried-well). *Usha* illuminating even the dark deep pit raises the hope for the man fallen in the well. The mantra's poetic expression if presented

in an unembellished physics statement, one would read it as – if the Sun is not overhead, the direct solar ray does not reach the bottom of a deep dark pit and the only light reaching there is twilight scattered due to the air in Earth's atmosphere. The sixth bullet (RigVeda, 1/123/6) exhibits twilight's one of the most important properties that it illuminates substances from above. This is delineated by the term *उदाविष्कृण्वन्ति* (*udaavishkrinvanti*) in the mantra which means 'revealing from above'. This is why this author used the term 'zenith' for *udaavishkrinvanti* in the sixth bullet. These mantras are therefore a source of considerable physics observation on the light phenomenon in the Earth's atmosphere.

Now the full translation and discussion on the RigVeda (1/123/8) mantra, which ties down *Usha*'s geographic extent on the surface of the Earth, is presented. This mantra also reveals that the hard number in *yojan* distance ascribed to the *Usha* phenomenon is a difficult experiment in physics that must have been conducted by the *rishis*. The mantras in these *suktas* suggest extensive indulgence of ancient people in scientific observation on the twilight phenomenon. The RigVeda mantra (1/123/8) and its full translation is presented below:

सदृशीरद्य सदृशीरिदु श्वो दीर्घं सचन्ते वरुणस्य धाम ।
अनवद्यास्त्रिंशतं योजनान्येकैका क्रतुं परि यन्ति सद्य: ॥ RigVeda (1/123/8)

With word-conjugation taken care of, the transliteration and word-meaning is as following:

**Word transliteration and Meaning**

सदृशी: (*sadrashih*) = unaltered, अद्य: (*adyah*) = today, सदृशी: (*sadrishih*) = unaltered, इत् (*it*) = it, or the emphasis on 'it be known', उ (*u*) = or, otherwise, श्व: (*shvah*) = next day (tomorrow), दीर्घं (*deergham*) = vast, big, great, सचन्ते (*sachante*) = caused by or results from or born out of, वरुणस्य (*varunasya*) = that of Varun (the atmospheric water - air - ocean system), धाम (*dhaam*) = home (for Varun's home the Earth's atmosphere) ।

अनवद्या: (*anvadyaah*) = demonstration of qualities, exhibiting its effect, त्रिंशतम् (*trinshatam*) = thirty, योजनानि (*yojanani*) = *yojans*, एकैका (*akaika*)= in

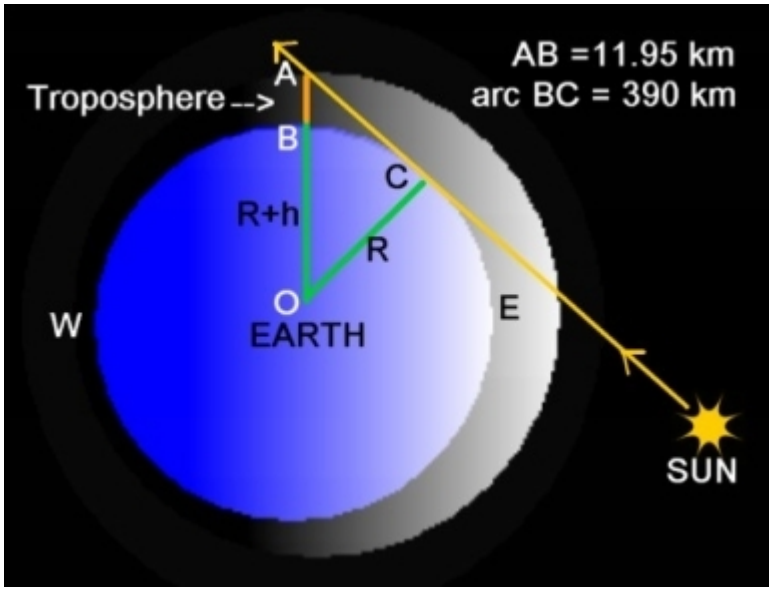
concatenation or in succession, क्रतुं (*kritum*) = creating action, परि यन्ति (*pari yanti*) = attains repeatedly, सद्य: (*sadyah*) = swiftly ॥

**Mantra Translation**

> "*The Usha with its immutable occurrence is born daily in the vast home of Varun (atmospheric water-air-ocean system) and moves swiftly demonstrating its qualities in concatenation up to 30 yojans*". (RigVeda, 1/123/8).

The repeated theme in this and other mantras of these two *suktas*, e.g. "*….you come without fail...*" in (1/123/9) is *Usha*'s daily occurrence. In addition to this the mantra states that this phenomenon is born daily in the vast home of *Varun Devata*, the *devata* of waters. Since waters are in oceans and in the Earth's atmosphere in the form of ubiquitous clouds, the *Varun Devata* in the Vedic definition is the *atmospheric water-air-ocean system*. Because it is born daily in the vast atmosphere, the mantra (1/123/5) cited under a bullet above called it the *young daughter* of *Varun*. The daily birth of the twilight phenomenon in the vast atmosphere as depicted in the mantras is exactly how the twilight phenomenon is defined in modern atmospheric physics; with the exception that the Vedic definition is more beautiful and poetic with several unique observations never narrated before in physics.

The other point in the above mantra and in the other mantras (bulleted items) is *Usha*'s virtues where the illumination of the objects of the Earth being important. A remarkable observation in the above mantra is its 30 *yojan* long swath of illumination that keeps moving fast on the surface of the Earth westward of sunrise point in an एकैका (*akaika*) fashion. The term *akaika* means 'one-after the other'. This was appropriately translated by this author as the concatenating illumination where a 30 *yojan* long illuminated swath keeps moving successively fast towards the west as the Earth turns. This process exhibits one of *Usha*'s dynamic properties.




The sketch of the Earth and the solar rays (not drawn to scale) depicted the geometry of the twilight (*Usha*) phenomenon. The circle represents the spherical Earth which spins at a high speed from West to East. When the direct solar ray reaches tangentially at a point C, it is sunrise at C. The same ray keeps penetrating the atmosphere above the Earth's surface west of C. This ray on interaction with the air molecules and aerosol in the atmospheric layer scatters diffused sunlight towards the Earth's surface shown by illuminated atmospheric layer in the form of an arc above the Earth surface and around it. Now consider a point B due west of C directly below the point A on the ray at a height h above ground. All points on the ray between C and A send scattered light to the point B and to all other points between C and B on the curved surface of the Earth. This indirect light that illuminates the objects on Earth, west of C is twilight, the *Usha* of the Veda. This RigVeda mantra states that the distance between the sunrise point C and the point receiving first twilight at B, west of C is 30 *yojan*. Using 1 *yojan* equal to 13 km as discussed earlier, the distance BC is 390 km due west of C the sunrise point.

The arc distance BC can be measured by measuring the time duration between the onset of twilight at B and the onset of sunrise at B, provided one has the knowledge of spherical geometry/trigonometry, the spin rate of the Earth, the circumference or the radius of the Earth. One spin of the Earth takes 24 hours which is equivalent to the circumference of the Earth 40066.4 km. The 390 km sector of Earth's circumference corresponds to 14

minutes. Therefore the onset of twilight at B in the diagram is 14 minutes before the sunrise at B. This is extremely close to the definition of the morning/evening twilight. During this time the indirect sunlight (scattered sunlight) received from the height of the atmosphere is BA = 11.95 km.

The height of the scattering region of the atmosphere BA 11.95 km is interesting because on an average, in mid-latitudes, this is the tropopause-height above sea level. Tropopause is the upper boundary of troposphere. Troposphere is the atmospheric layer which is laden with particulate matter and aerosol and where all weather phenomena occur. As an atmospheric physicist this author is well aware of the fact that most of the solar radiation observed in twilight experiments is due to scattering in troposphere. Therefore, the physics experiment by the *rishi* assigning 30 *yojan* due west for the first appearance of *Usha Devata* before sunrise indeed is of considerable historical and physics significance**.** It is quite remarkable. This also leads to the fact that the conversion factor of 1 yojan equal to 13 km is quite reasonable.

A rishi having the knowledge of spherical geometry/trigonometry, the circumference/radius of the Earth is remarkable by itself and shows a high level of advancement in the. To carryout an experiment today to determine the twilight swath to be 390 km in the west of the sunrise point one needs more than one observer with their clocks synchronized and equipped with possible long-distance communication, separated east-west by a few hundred km to begin with. The fact remains that the mantra has given a hard number for the distance BC. It did not give 5 *yojan* or 50 *yojan* but it is 30 yojan, implying that a measurement was involved. It is mind-boggling!

This RigVeda mantra and many other mantras in the four Vedas, that present mysterious deductions on physical phenomena with real concrete numbers, make it glaringly obvious that the knowledge in the Vedas is an outcome of highly developed intellect among those who formulated the Veda mantras.

Under the eighth bullet listed above (RigVeda, 1/123/12), a unique expression for *Usha*'s movement is cited – '*Usha moves in reverse yet comes back every day following the rule of Nature…*'. The fact is that the Earth's daily spin would cause *Usha* to successively move in 'reverse' at a high rate. From the daily spin and known geometry of the Earth one finds that the *Usha'*s illuminated swath moves at a speed of about 464 meters in one second which is faster than the speed of sound in air; latter being 343

meters per second. Presumably no known vehicles or horses existed during the Vedic times that are known to travel at this speed, which could have been employed for in-situ measurements on twilight. The only conclusion on *Usha* starting at 30 *yojan* west of sunrise point is that the *rishi* had the knowledge of atmospheric physics and the speed of illumination on the surface of the Earth. This is indeed a mind-boggling realization of the knowledge imparted in an ancient Vedic mantra.

Another mantra's amazing observation under the fifth bullet, that – "… *your अन्यत् अद्यौत् (anyat adyaut) the secondary illumination, while residing between night and the day that flow in the perennial cycle of Nature…'* (1/123/7) further highlights the physics of the phenomenon which is none other than the phenomenon of twilight with the diffused illumination being secondary illumination. A bigger mind-boggling science observation from the Vedic Literature is given below.

## The Mind-boggling Case of Space -Time Relationship: the Speed of Light in the Vedic Literature

Of the five Vedic entities presented here that form a set of causes in the creation of the universe, the Time and Space are of direct significance in developing physics of natural phenomena and advancing science knowledge in general. Under the sub-heading of "Measure of Time-entity: Small Time Scale of the Aryans" the sub-section entitled 'The Mind-Boggling Case of Nimesh' was presented. There it was said that the practical unit of *nimesh* could not have been derived by ancient *rishis* without a rigorous experiment in physics, here is yet another mind-boggling case where Space and Time, both are involved.

The simplest application where space and time are related is through the motion of an object. For example the speed of the Earth around the Sun being about 30 km/sec (= space/time) is the same as 0.41 *yojan*/*nimesh* assuming 13 km in a *yojan* and 8/45 sec in a *nimesh*. This conversion was

straightforward because the conversion between a second and a *nimesh* was established in Table 5.5 and between a kilometer and a *yojan* was established under the sub-heading "Case of the word mitra → metre". The mind-boggling mystery is in the *shloka* written by Acharya Sayana (14th century CE) that was composed as the interpretation of a statement in Taittireeya Brahmana. Taittireeya Brahmana is one of the most ancient books on interpretations of mantras in the Krishn-YajurVeda. Taittireeya Brahmana belongs to the far antiquity of the Vedic civilization anterior to the Milestone established in Chapter 3 as February 18, 3102 BCE. Acharya Sayana's *shloka* is on the reading of Taittireeya Brahmana statement (2/8/7/51) on "*Doore Arthah Tarani-r-bhrajmanah*" which means the "*Meaning of Distance in Sun's Illumination*". A related mantra in Taittireeya Samhita ((1/4/31) is under "*Sooryo Atigreha*" (Sun the Special (extreme) Object of Astronomy); Soorya and Tarani being synonyms for the Sun. Hence, Acharya Sayana's *shloka* is on the speed of light. The original Taittireeya Brahamana statement is in prose to which Acharya Sayana gave a poetic form in the 14th century CE and the original thought of Taittireeya Brahamana is preserved in Acharya Sayana's *shloka* (see references in Ved Vidya Nidarshan, a Hindi publ. 1959 by Pandit Bhagvaddatta). The shloka by Acharya Sayana is:

योजनानां सहस्रे द्वे द्वेशते द्वे च योजने ।
एकेन निमिषार्धेन क्रममाणो नमोऽस्तु ते ॥

(Sayana / Taittireeya Brahmana, 2/8/7/51)

**Transliteration:**

"Yojanaanaam sahesrey dve dveshate dve cha yojane ।
Eken nimishaardhen kramamaano namoastute" ॥

**Translation:**

*"The sunlight spreads through a distance of 2202 yojan in one half of a nimesh."* (Taittireeya Brahmana, 2/8/7/51).

There is no other or different translation or meaning of Acharya Sayana's *shloka* (couplet) than what is presented in this sentence. Whichever angle one takes to translate the *shloka*, one arrives at the fact that the Sun's *bhrajmanah (*illumination) spreads (moves) at the rate of

2202 *yojan* in 0.5 *nimesh*. Sun's apparent disc itself is never seen spreading and certainly not through 2202 *yojan* and that the two numerals respectively represent the distance (*yojan*) and the time (*nimesh*) the Taittireeya Brahmana's statement relates to the rate of spread of sunlight. It is obvious that Saayan did not perform calculations for the speed of light as taken up by this author. Implicit in the 'spread' of sunlight is the 'speed of sunlight' because the two numbers given by the Taittireeya statement are distance and time. It is just a difference in expression. For example a meteorologist announces in the metaphor of 'Sun rise at 06:00 hours' knowing that the Sun never rises with respect to the Earth and it is the Earth that rotates to reveal the sunrise. Also in Rishi Taittireeya's statement, transformed by Acharya Sayana into a couplet, the spread of the Sun's *bhrajmanah* (illumination) means the spread of the solar rays and not the spread of the unchanging solar disc. Additionally, the spread of the Sun light is not the motion of the Sun in the sky. It is obvious that Sayan did not perform calculations for the speed of light as provided by this author.

Let us now examine the numbers cited in the shloka. A first glance at the number 2202 yojan in half the *nimesh* tells us that this unrounded number is not the result of a guess-work. The number 2202 *yojan* being 28,626 km is a large number about two and a quarter times the diameter of the Earth. Glaringly obvious here is that it is a number measured either in an experiment or it is the result of a calculation. This number being quoted as the speed of Sun's illumination in one half of a *nimesh*, further strengthens this author's contention that it is a measured speed of light by the *rishi* who was capable of measuring the fraction of a *nimesh*, the one half of a nimesh being only 4/45 second (about 89 milliseconds). No calculation related to the Sun can be performed in isolation without the input of some other measurement. Therefore this number decidedly is an outcome of observation followed by calculation. In a number such as this, an accuracy of at least 1 yojan per half *nimesh* is preserved. The second important feature of this statement is the half *nimesh*. A *nimesh* itself is about $1/6^{th}$ of a second and to assign half a *nimesh* to the distance of 2202 *yojan* confirms that it is a measurement of the speed of solar rays that was recorded in the book of Taittireeya Brahmana.

One *yojan* being equal to 13 km and one *nimesh* being equal to 8/45 seconds (Table 5.5), the speed of light based on the Taittireeya data can be calculated as,

2202 *yojan*/0.5 *nimesh* = 2202x13 km / (0.5x0.177778) sec = **$3.22 \times 10^5$ km/sec**.

This is an extremely high speed. This speed is well beyond the speed of any known physical object. This is the speed of light. The obvious question to a physicist who works with space and time and the velocity of light in particular is:

"*How is it that the speed of light in the ancient Taittireeya Brahmana turns out to be 3.22 x$10^5$ km/sec, which is so close to the speed of light 3.00 x $10^5$ km/sec measured by modern physicists*"?

There is only one answer to this question - the number 3.22 x$10^5$ km/sec is so close to the speed of light because it is **nothing else but the speed of light,** the difference being that it was measured by an ancient *rishi*, well before the modern 'history of speed measurement of light' began. When the Brahmana statement associated the Sun's illumination with this speed, it is implicit that the Rishi Taittireeya is talking about the speed of the solar rays. Hence this author feels that the Vedic Space-Time relationship just cited here is **nothing short of mind-boggling.** The time assignment of one half of a *nimesh* (about 89 milliseconds) to this measurement also suggests that accurate space and time measurement techniques were at hand of the *rishi* who logged the numbers 2202 *yojan* and 0.5 *nimesh* in the Taittireeya Brahmana eons ago before the modern science was even conceived. Also, the *shloka* of Acharya Sayana in the 14$^{th}$ century is well before any activity in the West on the measurement of the speed of light. For this author, the Vedas continue to present wonder-upon-wonder.

# Analysis

Light being the fastest physical entity in the universe is difficult to measure accurately. Its speed represented by the letter c is now accepted by scientists as 2.99792458x$10^5$ km/sec in vacuum. It is a physical constant for all wavelengths of radiation and known at the present time as the greatest speed that is known to exist in the universe. Regardless of the speed of light the conversion of 1 *yojan* to 13 km is generally accepted by scholarly.

When this author used the same conversion factor it yielded the speed of light extremely close to the real value arrived at by modern physics. Conversely therefore, because this conversion factor between *yojan* and kilometer gives a very realistic speed of light, 13 km in 1 *yojan* should be deemed an accurate relationship between the two distance units. Even if one took 8 km equal to 1 yojan, the calculations for the speed of light using Taittireeya data will yield 2 x$10^5$ km/sec, a speed not reached by any known object other than a photon of light, however, quite inaccurate for the speed of light. Since the Taittireeya Brahmana in this regard talks about nothing else but the Sun, the speed determination of 2202 *yojan*/0.5 *nimesh* yielding 3.22 x $10^5$ km/sec is the speed of light determined by a *rishi* far in the antiquity of Vedic civilization.

# A Historical Note on Light Speed Measurement in Modern Era

Accurate determination of the speed of light in the Western civilization is not very old. Not only the original reference on speed of light, in Taittireeya Brahmana, is indisputably extremely old, even Acharya Sayana' *shloka* based on it, composed in the 14$^{th}$ century is at least three centuries older than the meaningful effort in the West made for measuring the speed of light. The reader may be curious to know when and how the Western civilization developed the methodology for accurate determination of the speed of light. From this history one could assess and compare the level of wisdom that existed in Vedic times, the wisdom that was adversely affected after the Mahabharata War five millennia ago.

The modern history of understanding and measuring of light in the Western civilization is said to have started with Aristotle (384 - 322 BCE) who thought that the light is not something that moves but is present. This cannot be considered as a start for measuring the speed of light. The other Greek mathematicians like Euclid (300 BCE) known as the father of geometry, Heron of Alexandria (10-70 CE) known as the 'greatest experimenter of antiquity' and Ptolemy (90-168 ACE) the geographer, astronomer and astrologer, all theorized that light is something emitted by the eyes and its speed must be infinite because all objects near and at infinity were revealed by the eye instantly. This also cannot be considered

as the beginning of the process for measuring the speed of light. From all standards of time scale, this period in history is quite recent compared to the Vedic period of Taittireeya Brahmana where light is a measurable phenomenon with motion at 2202 *yojan* per 0.5 *nimesh*.

It was an Iraqi physicist Alhazen (965-1040 CE) who had the first scientific basis to suggest in 1021 CE that light starts from the objects and reaches the eye which detects it, making light an entity with finite speed. Still there is no sign of measurement of the speed of light! Then came Acharya Sayana's *shloka* in the 14$^{th}$ CE on the statement in Taittireeya Brahmana (2/8/7/5) formulated in the far antiquity of Indian civilization. This ancient statement gave the speed of light very close to its real value.

Acharya Sayana's period in the Indian history is well-known. A brief discussion on Acharya Sayana was included in Chapter 4 under the sub-heading of "Puranas". As the Prime Minister of the Vijayanagaram Empire with the empire constantly facing the attacks from the Moslem invaders coming from the North India he remained a prolific writer authoring over 25 volumes of interpretive commentaries on ancient books in Sanskrit Literature including five original books of his own. It was Acharya Sayana's hand-written RigVeda manuscript that Max Muller received in Cambridge, England, for English translation.

Numerous Veda mantras could be cited here to show that light for the Vedas is a real entity. The *sapt-rashmi* is the Vedic adjective to the sunlight with seven colours and it is emitted by objects and fire and it travelled with a high speed from the source to the sense of seeing, the eye. The brilliant Acharya Sayana put the Taittireeya Brahamana statement into a metered *shloka* couplet, presented above. Two important points are to be noted here: (a) that in the 14$^{th}$ century CE, there was nothing worthwhile in the area of light speed-measurement for Acharya Sayana to copy or extract from and put it down in the *shloka* couplet and (b) that no one outside India of 14$^{th}$ century CE had knowledge of relating *nimesh* to second and *yojan* to kilometer for Acharya Sayana to compose the couplet on. Since the original Taittireeya Brahamana principle on the speed of light was written eons before Sayan and Aristotle (384-322 BCE), the measurement of the speed of light 2202 *yojan* per 0.5 *nimesh*, which is 3.22 x $10^5$ km/sec, is indigenous to ancient India.

The debate on finite versus infinite speed of light continued in the West for three centuries after Acharya Sayana. Well-known European physicists

of the 17th century, Johannes Kepler (1571-1630), Francis Bacon (1561-1626) and René Descartes (1596-1650) concluded that the speed of light was infinite. After some experiments in optics by Isaac Beeckman (1588-1637), Galileo (1564-1642) and Robert Hooke (1635-1703) it was determined that the speed of light was finite. From Ole Romer's (1644-1710) astronomical measurements, Huygens (1629-1695) came up with the speed of light to be 2.2 x $10^5$ km/sec, a value that was 27% lower than the actual speed of light and Sir Isaac Newton (1668-1704) reported the speed of light to be 2.1 x $10^5$ km/sec that was 30% less than the actual value. Finally Bradley's (1693-1762 CE) value of 2.98 x $10^5$ km/sec, determined by using star aberration and speed of the Earth around the Sun came very close to the real value. Other serious optical experiments followed yielding differing values in the same ball-park. In 1862 CE the speed of light determined by Fizeau (1819-1896 CE) was 3.13x $10^5$ km/sec (4% higher). Faucault's (1926-1984 CE) value was 2.98 x $10^5$ km/sec. Revisions of the value of the speed of light continued in the 20th century reaching the most accurate value of 2.99792458 x $10^5$ km/sec.

This was the Western historical perspective on light. First the light was a subject of philosophy, then a real phenomenon traveling with a finite speed and finally it was deemed as a measurable phenomenon. In the ancient Vedic civilization it may have gone through the same process of iteration to reach the value of 3.22 x $10^5$ km/sec which is an over estimation by only 7% compared to the scientific measurements in modern times. This is remarkable and mind-boggling!

# Index


'Electro-Magnetic Force', 97
'*ex nihilo*' principle, 79
'Gravitational Force', 97, 98
'u' and 'd' quarks, 98
"Does Time Exist?", 28
1 nimesh = 8/45 sec, 369
Aadi Shankaracharya, 132, 140, 146, 147, 193, 200, 202, 203, 204, 205, 209, 210, 213, 214, 229, 257, 269, 284, 340
Acharya Gyaneshvar ji, xvi
Acharya Udayaveer Shastri (1894-1991 CE), xvi, 186
*Achetan* (an entity without consciousness), *Agjyaan* (a non-knowledge-entity), *and Andham* (without the ability to see itself, 6
Advaita Vedanta Philosophy, 64
*Adwaita-Vedanta* (the philosophy of non-dualism), 146
*Ahankaar-tatva,* (Ego-entity), 334
Albert Einstein, 92, 385
Albert Schweizer, 22
Alexander the Great (356-323 BCE), 187
angular momentum, 81, 110
Antariksh - the Vedic Space is Curved, 384
***antariksham***, 378, 379, 384, 385
**Anthropic Principle**, 89, 112, 116
**Antiquarian**, 281, 283, 284
Archaeological Survey of India, 152
Aristotle, 29, 30, 32, 33, 34, 35, 38, 64, *See*
Arya Patrika, 221
Arya Samaj, 69, 185, 226
Aryan Civilization, 1, 136, 154, 156, 190, 223, 247, 277, 283
Aryan Hypothesis, xiii, 71, 152, 183, 215, 219, 220, 223, 267
Aryan Invasion Theory, xiii, 71, 142, 152, 154, 177, 183, 215, 219, 220, 223, 267
Aryans, 1, 2, 16, 31, 32, 40, 70, 71, 72, 73
Aryavart, 136, 141, 142, 143, 152, 154, 155, 156, 158, 160, 161, 166, 173, 174, 176, 177, 178, 179, 180, 181, 182, 183, 191, 193, 215, 220, 242, 246, 247, 252, 253, 255, 256, 265, 357, 367, 373
Aryavart (Bharatvarsh now India), 154
Asata-state, ix, 9, 16, 46, 49, 52, 55, 77, 78, 98, 101, 302, 313, 322, 323, 327, 332, 345
Asata-state of matter, ix, 9, 49, 55, 77, 98, 323
Ashtadhyayi, 186, 232, 250, 285, 294
Asia Minor, 143, 152, 154, 156, 189, 223
Augustine's *creatio ex nihilo*, 79
Avantika (now Ujjain), 31
Avinash Chandra Das, 185
*ayan chalan*, 184

Ayodhya, xii, 137, 141, 154, 166, 174, 176, 178, 242, 246, 256, 257, 286
*Ayurveda* (Science of Aging), 246
Bal Gangadhar Tilak (1856-1920), 184
Baryogenesis Era, 103
*Bertrand Russell*, 40, 41, 42
best matching, 28
Betula Utilis or Himalayan Silver Birch tree, 278
**Bhagavadgita**, 230, 254
Bhagvadgita, 19, 22, 59, 70
*bharati, sarasvati* and *ila*, 244
Bhaskaracharya in the 12th century CE, 17
*Bhavavrittam sukta*, 77, 78
Bhishm-pitamaha, the Grandfather-Bhishma, 137
*bhoj-patra*, 68, 194, 200, 272, 275, 277, 283
Big Bang Hypothesis, ix, xi, 8, 21, 28, 43, 75, 91, 94, 100, 108, 111, 116, 119, 287, 302, 304, 331, 335, 382, 383
Big Bang in Ancient Logic, 124
Big Chill, 94, 109, 120, 121
Big Crunch, 94, 101, 120, 121
**Big Flood**, 73, 362, 364, 365, 366
Blackbuck, 179, 180
bosons, 98
Brahmana, 9, 15, 19, 21, 35, 36, 37, 38, 47, 48, 58
Briggs (at Roacs, NASA Ames Research Center, Moffet Field, California), 2
British Education Plan for India, 290
Bruno Bertotti, 28
Buddhism, 147, 154, 161, 193, 202, 229, 269, 282, 283, 342
Canadian Broadcasting Corporation, 16
Carl Edward Sagan, 1
cause-and-effect, 4
**Cause-Effect**, 60
Chandragupta, 188, 189, 190, 199
Christian Calendar Discrepancy, 149, 151
Classical Cosmological Theories, 125
Classical Mechanics, 79, 92
Claudius Ptolemy (87 - 150 CE), 29
Clockwork Universe Theory, 79, 81, 82
Common Era (CE), 132, 147, 149, 151
Cosmic Inflation, ix, 44, 45, 101, 102, 111, 112, 113, 114, 115, 118, 119, 120, 122, 123, 124, 125
Cosmic Microwave Background Radiation (CMBR), 103, 113
Cosmological and Astronomical Vedic Terms, 128
**Cosmological Principle**, 88, 106
**counting system of the Aryans**, 353
creation, 4
Creation Energy Field, 47, 314
creationism, grand design, Darwinism, 4
Creator-Entity (Purush-tatva), 310
cyclic universe, 54
Dark Energy, x, xii, 23, 24, 25, 26, 28, 29, 45, 50, 108, 109, 110, 111, 119, 120, 126, 304

Dark Energy / Vacuum Energy, 108
Dark Matter, 106, 107, 110, 119
Darshans, x, xii, xv, 12, 14, 21, 22, 50, 53, 64, 65, 125, 133, 140, 172, 186, 187, 201, 224, 229, 230, 258, 259, 260, 263, 282, 283, 284, 287, 311, 313, 315, 326, 330, 341, 342
Darwin's theory of evolution, 89
Dawkins, 16
Deficiencies in Big Bang Hypothesis, 111
Deficiencies of Big Bang Hypothesis, 102
degrees Kelvin, 8
*Devnaagri* (Sanskrit), 69
Devnagari script, xi, 272
*dhatu*, 6
Dhritrashtra, 137, 139, 188
Dmitri Ivanovich Mendeleev, 238
Doppler Effect, 21, 93, 119
Doppler shift, 93
Drishdvati, 156, 157, 162, 163, 165, 166, 177, 247
Duryodhan, 139
**Dvaapar-yuga**, 359, 360
Dwarka, 132, 139, 140, 167, 168, 189, 204, 212, 214
Earth's Gravitation, 35, 79
**Earth-Tortoise Theory**, 40
Edwin Hubble, 93
*eekshana* force, 307, 308
**Efficient-Cause**, 61
Einstein, 8, 10, 11, 22, 24, 28, 30, 41, 45
Einstein's Theory of Relativity, 10
Electro-Magnetic Force, 97, 307
**Eternity of Bubbles**, 114, 116
Euclidean Geometry, 117
exo-planet, 59
**Expanding Universe - a Vedic Discovery Eons Ago**, 383
Extinct Sarasvati River Project, xiii
False Vacuum, 114, 116, 118, 119, 120, 121, 125
Fast Particles, 85
February 18, 3102 BCE, x, xii, 32, 33, 70, 133, 134, 140, 144, 145, 146, 148, 183, 185, 199, 220, 261, 288, 373, 396
Five Eternal Entities, 310
Five Principles of Modern Cosmology, 88
**Flatness Problem**, 117
Force Transfer, 99
force-carrier particles, 98, 99
**Four Fundamental Forces of Nature**, 97
Frederick Pincott (1836CE – 1896CE), 221
**Fundamental Particles**, 96
General Relativity, 45, 85, 100, 108, 123, 376
Genome Project, 144, 153
Georges-Henri Lemaitre, 75
Gilbert (1893), xxx
Gliese 581g, 59

Grand Design, 27, 43, 44, 55, 56, 58
Gravitational Theory, 46
Greenwich, 148, 150, 151
gurutva (gravitation), xiii, 32, 35, 79, 110
H. H. Wilson (1786-1860), 241, 243, 294
Harappa, 152, 167
Hastinapur, xii, 22, 31, 136, 137, 140, 143, 150, 154, 168, 170, 171, 188, 190, 261, 388
Hastinapur (near Delhi), 22, 31
hedrons, 103
Himalaya, 157, 161, 163, 175, 204
*Hindus*, 1
Hiranya-garbh, 46, 47
*homogeneous and isotropic*, 88, 119
**Horizon Problem**, 113, 114
Hoyle-Narlikar gravity theory, 125
Hubble Telescope, 111, 117
Immeasurability, 83, 311, 312
Indika, 189, 190, 199, 215
Indus Valley Civilization, 152, 167
*inherent angular momentum*, 110
ISRO (Indian Space Research Organization), 162
J. Robert Oppenheimer, 22
***Jal Plaavan***, 365
*janm-patra'* (birth certificate), 280
Jean-Sylvain Bailly (1736-1793 CE), 145
Jesus Christ (0 CE), 147
John Playfair (1748–1819 CE), 145
Julian Barbour, 28
Julius Lothar Meyer, 238
Kalhan, xii, 132, 190, 191, 192, 198, 280
**Kali-yuga**, 70, 210, 215, 261, 358, 359, 360, 361
*Kali-Yuga*, 32
Kali-Yuga and the Planetary Conjunction, 145
Kali-Yuga Calendar, 146
Kaliyug-Calendar, xii
*Kantian-style argument*, 48
Kashmir King Gonand, 191
Kauravas, 139, 190, 261
Kautilya Chanakya (350-283 BCE), 188
King Bhoj, 264, 265
King Manu, xiv, 137, 141, 154, 156, 166, 172, 174, 181, 219, 246, 252, 256, 289, 355, 372
King Shalivahan (87 CE), 147
King Shantanu, 137, 154
King Videgh Mathav, 173, 174
King Vikramaditya (57 BCE), 147, 265
**King Vrihadabal**, 142, 257
Kingdom of Mewar, 280
Krishn, 139, 140, 142, 148, 154, 168, 169, 171, 179, 187, 189, 190, 191, 192, 198, 199, 210, 212, 251, 254, 261, 262, 263, 267, 330, 339, 361, 388, 396
Krishna, 22, 23, 278, 367, 390

Kurukshetra (near Delhi), 22
LANDSAT of NASA, 162
laws of Nature, 3
Lemaître's 'Hypothesis, 93
Leonard Mlodinow, 27, 43, 44
lepton, 96, 102
**Light Speed Measurement**, 398
linear momentum, 81
Lord Macaulay in 1834 CE, 268
Lunar Dynasty, xii, 136, 154, 261
Maart-aand (Mortal-ovate), 25
Macaulay, 268, 288, 290
Macdonell (1854–1930), 241
**Mach's Principle**, 89
Maddhya Desh, 156, 157, 158
Maeterlink (1862-1949), 185
Mahabharata, 10, 22, 31, 33, 35, 36, 38, 42, 65, 70
Mahidhara, 225, 241, 266
Mahidhara (1589 CE), 225, 241
Manu's Ordinance, 253
Manusmriti, vi, x, xiv, 9, 72, 137, 141, 146, 154, … 158, …172, 176, 177, …, 186, 189, 215, 230, 246, 252, .. 263, 271, 278, 285, 289, 293, 294, 319, 334, 355, 356, 357, 361, 368, 370, 372, 373
mass distribution, 325
material-cause, ix, xi, xii, 14, 23, 26, 47, 48, 49, 50, 51, 52, 55, 61, 62, 64, 66, 79, 228, 308, 309, 311, 312, 313, 315, 317, 332, 338, 342, 343, 348
**Material-Cause**, 61
Mathura, 139, 140, 168, 186, 189, 190, 191
Maurya Empire, 188
Max Muller, xiii, 31, 70, 142, 146, 152, 185, 189, 200, 215, 220, 223, 240, 247, .. 255, 266, …, 284, 288,… 294, 295, 296, 297, 298, 399
Meemansak, 270
Megasthenes (350 BCE - 290 BCE), 189
Milky Way Galaxy, 24, 72, 103, 333, 366
Mind-boggling Case of Space -Time, 396
Mlodinow, 44, 45, 46, 48
Mohenjo-Daro, 152, 167
Monier-Williams (1819-1899), 241
morning-twilight, 18
Mount Kailash, 162
Multiple Universe Hypothesis, 112
**Multi-Universes**, 116
Multiverse Hypothesis, 116
Munn, 85, 86
Nand Dynasty, 188
NASA, 2
National Genome Projects, 215
**Nature of Aapah**, 325
Nature-entity (Prakriti-tatva), 314, 379
**Neutrality in Nature**, 322

neutron, 11, 97, 104, 330, 331
Newton, xiii, 30, 35, 56, 75, 79, 80, 81, 82, 83, 84, 91, 92, 94, 108, 126, 305, 306, 346, 387, 400
Newtonian Mechanics, 92
Nicolas Copernicus, 30
Nighantu, 19, 32, 57
Nirukt, xi, xv, 19, 32, 33, 57, 186, 225, 230, 233, 241, 242, 243, 244, 246, 250, 251, 258, 266, 269, 272, 285, 294, 310, 318, 373, 377, 378, 379, 380, 381, 386
nucleosynthesis, 103
Observable Universe, 107
*optical illusion*, 105
**Ordinary-Cause**, 62
P. V. Holey, 170
Paleo-Yamuna, 165
*paraant-kaal*, 361, 362
*paramanu*, 11, 12, 52, 78, 322, 331, 332, 335
*parimandalam = spherical*, 332
*Paschim Sagar* (Arabian Sea), 132
Philosophiæ Naturalis Principia Mathematica, 79
Photon and Munn (Mind-entity), 85
Planck Era, 8, 95, 97, 98, 99, 100, 114, 120, 123, 124
Planck-length, 8, 12, 95
Planck-time, 12, 17, 25, 45, 55, 94, 95, 98, 100, 101, 114
**planet Earth**, 31, 32, 33, 34, 35, 377
*Plato*, 28
***Prajapati***, 47, 318
pralaya, xii, 77, 94, 121, 301, 302, 303, 304, 306, 319, 320, 323, 326, 357, 360, 362, 385
**Prayag**, 157, 161, 174, 175, 176, 177, 178, 196
precession of the equinox, 184
Primeval Atom, 92, 93
**Principle of Equivalence**, 89
principle of uniformity, 88
**Prof. Hawking**, 44, 340
proton, 11, 96, 97, 104, 330, 331, 335
Ptolemy, 29, 30, 32, 33, 34
Pundit Gurudatta Vidyarthi, xiii
Puranas, 32, 33, 41, 42, 143, 177, 210, 230, 255, 263, 264, 265, 266, 282, 399
Quantum Mechanics, 28, 45, 76, 79, 100, 109
quantum of consciousness, 5
Quantum Physics, 82, 102, 115, 117, 118, 124
Quantum Theory, 45, 95, 100
quark, 11, 96, 98, 103, 321, 328, 330, 331, 388
**Quark-Lepton**, 101, 102, 122, 123
R. T. H. Griffith (1826–1906), 294
Raja Puru, 187
Rajasthan, xv, 69, 158, 161, 162, 163, 164, 167, 181, 219, 280, 281
Rajtarangini (Raj-Tarangini), 190
Ram, xii, 137, 141, 142, 174, 176, 183, 197, 210, 222, 230, 253, 256, 257, 295
Ramayana., 141, 167, 176
Rann of Kutch, 158, 162

Ravana, 241
**Red-shift**, 118, 349
**Red-shift Problem**, 118
Relativistic Mechanics, 92, 115, 123
RigVeda Bhasya, 244
Rishi Gautam, 125, 140, 174
Rishi Kanaad, xiii, 12, 21, 22, 23, 35, 52, 53, 54, 79, 113, 234, 260, 303, 304, 305, 332, 340, 341, 352, 371, 386, 387
Rishi Kapil, ix, 49, 50, 51, 52, 53, 260, 311, 312, 313, 314, 320, 322, 323, 329, 330, 340, 341
Rishi Paanini, 225, 232, 250, 269, 270, 285, 294
**Rishi Vaarshganya**, 339, 340, 342
Rishi Valmiki, 141, 176, 230, 253, 256
Rishi Vedvyas, 140, 142, 143, 154, 168, 169, 170, 171, 172, 201, 202, 229, 259, 260, 261, 262, 263, 264, 288, 289, 340, 341, 342
Rishi Yask, xi, xv, 19, 32, 33, 36, 225, 233, 241, 250, 269, 272, 285, 294, 310, 373, 374, 379, 381
*rishis* (sages), 1
**River Sarasvati Corollary**, 161, 166
Roger Penrose, the eminent British mathematician/cosmologist answered, 16
Royal Asiatic Society of London, 152
S. Kalyanaraman, 167, 171
Saankhya Darshan (Philosophy), ix
Saayana (14th CE), 241
Sagan, ix, 1, 2, 3, 6, 7, 13, 16, 30, 40, 54
Sanjeevani, 264
*sankalp-shloka*, 367, 368
Sanskrit, x,… xvi, 1, 2, 6, 9, 12, 25, 27, 30, 47, 48, 57, 62, 68, 69, ..79, 82, 86, 128, …140, ..147, 149, 151, ..166, 175, ..184, 186, …, 216, 220, … 248, , 256, …274, 275, 277, … 288, …310, 314, 321, 324, 326, 331, 342, 345, 346, 354, 361, 370, …387, 389, 390, 392, 399
Sata-state, ix, 10, 16, 46, 49, 77, 78, 101, 302, 313, 321, 327, 332, 345
Sata-state of matter, ix, 46, 77, 321
***Sata-Yuga***, 358
*sato-guna*, *rajo-guna* and *tamo-guna*, 11, 320, 321, 332
*satya* (**सत्य**), 27
Satyarth Prakash, 10, 18, 58, 64, 65, 66, 132, 140, 170, 187, 192, 193, 194, 198, 199, 200, 215, 242, 254, 260, 262, 263, 264, 265, 285, 307, 310, 361, 375, 376
Sayanacharya, 241, 294
Seleucus Nicator, 189, 293
Shabd Kalpdrum, 69
Shalivahan-calendar, 31
Shankaracharya, 31, 64
Shatpath Brahmana, xv, 130, 172, 173, 174, 285, 376
Siddhant Shiromani, 17
Sindhus, 154
Sir John Hubert Marshall (1876 - 1958 CE), 152
*Skambha*, 24, 110
Smritis, x, xv, 15, 64, 65, 70, 133, 156, 224, 230, 241, 252, 264, 284, 311, 313, 376
**Solar System**, 56, 58, 60
Soul-entity (Atm-tatva), 336

**Space the Flower of Creation**, 379
**Space-entity (*Aakaash-tatva*)**, 19, 375
space-time continuum, 7, 10, 11, 20, 28, 29, 45
space-time singularity, ix, 8, 9, 10, 12, 13, 39, 45, 46, 53, 78, 79, 94, 95, 108, 120, 121, 122, 124, 126, 379, 383
Special Theory of Relativity, 92
**Spiritual aspect of the Triplet**, 333
Srinivasa Raghavan, 170
Srishti-Calendar (Natural Aryan Calendar), 140
Srishti-samvat. *See*
St. Augustine (354 - 430 CE), 79
Standard Model, 95, 98
Steinhardt, x, 54, 112, 113, 120, 121, 126, 345
Stephen Hawking, 1
Strong Force, 97, 98
Sun Dynasty, xii
Surya Siddhant, 16, 17
Swami Dayanand Sarasvati, 10, 18, 58, 64, 65, 66, 69
Swami Dayanand Sarasvati (1825-1883 CE), xi, xv, 222
tachyon, 85
Taxila, 188
*teeryak* is – '*one that has directionality like the path of an arrow*', 23
**term *Aapah***, 324
Thar Desert, 158, 162, 164
The Sun Principle, 16
**the Vedic Big Crunch**, 9
Theory of Every Thing, 100
Theory of General Relativity, 11, 45, 75, 92, 98
theory of relativity, 7, 30
Theory of Relativity, 10
Thomas Babington Macaulay (1800-1859 CE), 290
**Time Division of 4.32 BY**, 355
Time-Entity (Kaalah-Tatva), 343
**Treta-yuga**, 358, 359, 360, 361
**Tri-property *Aapah* Particles**, 320
Triveni Sangam, 174, 175
***tuchchhayen***, 327, 345, 383, 385
Ujjain, 31, 148, 150, 151, 193, 196, 199, 200, 257, 264
Uncertainty Principle, 82, 115
Unified Field Theory, 46
**unit of Matter**, 321
universal constants, 4
Universal Gravitation Constant, 80
University of McGill in Montreal in 2008, 103
Upanishads, x, xv, 15, 53, 64, 65, 70, 156, 201, 221, 224, 230, 241, 257, 258, 282, 284, 285, 287, 311, 313, 320, 329, 342, 376
Urey (1951), xxxi
Vacuum Energy, 108, 109, 110
Vaisheshik Darshan, xiii, 12, 35, 53, 65, 234, 260, 303, 305, 332, 352, 371, 386, 387, 388
Valmiki Ramayan, 141, 176

Vanprasth Ashram of Rojad, Gujarat, xvi
*varna-system*, 253, 254, 255
Vedas, 1
Vedic Aryan Civilization of India, 1
Vedic astronomy, 17, 30, 59, 72, 134, 145, 146, 149, 170, 172
Vedic Big Bang, ix, x, xiv, 1, 9, 10, 21, 24, 25, 46, 47, 50, 55, 78, 91, 101, 110, 222, 253, 327, 360
Vedic Big Crunch Scenario, 9
Vedic Civilization, xii, 6, 19, 31, 40, 49, 66, 76, 82, 125, 128, 130, 134, 135, 141, 156, 166, 185, 227, 240, 242, 246, 267, 270, 284, 288, 370, 390
Vedic Cosmology, vi, ix, xi, xiv, 9, 10, 13, 14, 24, 25, 32, 55, 68, 70, 76, 77, 94, 101, 118, 119, 126, 127, 128, 129, 133, 172, 201, 215, 222, 228, 242, 300, 305, 316, 329, 360
Vedic Cosmology Principle, vi, 76, 94
Vedic Cosmology Scenario, vi, ix, x, xiv, 101, 215, 242
Vedic Creation Principle, 10, 49, 71, 78, 110, 300, 338, 383, 385
Vedic Literature, x, xii, xiii, xv, xvii, 1, 13, 17, 32, 40, ..56, 58, 68, ..132, 134, 135, 153, 162, 166, …186, 187, 221, …232, 237, 241, 246, 250, , 263, 269, 270, 283, , 288, 290, 291, 315, 330, 339, 342, 360, 375, 376, 377, 385, 396
Vedic Philosophy, xi, xv, 7, 10, 14, 26, 37, 38, 48, 49, 53, 56, 59, 62, 64, 65, 66, 67, 68, 70, 82, 94, 222
**Vedic Reference Hypothesis**, 134, 149, 153, 172
**Vedic Time Scales**, 372
**Vedic Trinity (Vedic *Trishtup*)**, 342
**Vedic Triune Atom**, 330
**Vedic versus Modern Science on Nature**, 334
**vernal equinox**, 148, 184, 185
Vidyanand Sarasvati, 1989, 225, 269
Vikramadittya, 31
Vikram-calendar, 31
Vindyachal, 161, 177
*Vinshan Region*, 157, 158, 164, 176, 219
Viscosity of Space, 324
W and Z boson, 98
Weak, 97
Weak Force, 97, 98
*Wheeler-DeWitt equation of quantum gravity*, 28
written manuscript, 268
*yaugik* and *rudhi*, 233
Yudhishthir, xii, 31, 132, , 136, , 140, 144, 147, ..166, 181, 187, 190, 198, 204, 208, 210, , 257, 260, 261, 262, 269, 270, 278, 279, 388, *See*
Yudhishthir-samvat, 31
*Zeta Piscium*, 144, 145
**ऊर्मिम्** (urmim), the waves, 329
**सत्य** (*satya*), 27, 29
**हिरण्मयमाण्डं** (hiranmayam-aandam), ix, 9, 11
**हिरण्मयमाण्डं** (*hiranmayam-aandam*), the golden-embryo, 11

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# Limited List of Vedic Terms often cited in the Book

| | |
|---|---|
| *Aapah* | An all-pervading tri-property fundamental state of |

| | |
|---|---|
| | matter |
| *aatma, atman* | soul |
| *acharya* | Teacher and scholar of high calibre |
| *Antariksh, Aakaash* | Space-entity, container of matter/energy of the universe, varies with eternal existence |
| *anaadi* | Entity without beginning, eternal |
| *Asata-state* | state of matter devoid of matter properties, indefinable matter state confined in diminutive space |
| *avi-vritsan* | (अविवृत्सन् ): repetitive circular motion as in the orbital motion of a planet |
| *avyakta* | indescribable |
| *bhuta* | matter/energy, *bhutaani* (plural of bhuta, includes all matter in both realms: animate and inanimate. *panch-maha-bhootas* (five-major-elements of philosophy) |
| *chakraprasaran* | represents two actions together: rotating around an axis and spreading radially keeping its circular shape |
| *Brahmn* | The Creator, purush - one who pervades all (details in Chapter 5) |
| *chakra* | wheel, an orbiting system |
| *chakrampari* | Circular motion on a perimeter as in an orbiting celestial body |
| *darshan* | philosophy |
| *deva, devata* | One with brilliant properties – a conscious-being or inert system of Nature essential to sustain creation |
| *dhoorshu* | (धूर्षु ): In the axis of rotation |
| *hiranmayam-aandam* | (हिरण्मयमाण्डं): *hiranya-garbh, hiranyand*, golden-embryo, premordial ovate/spheroid of Nature (matter), spheroid with golden brilliance |
| *Inddraprasth,* | Hastinapur, Ancient names of the capital now Delhi |

| | |
|---|---|
| *Kaalah, kaal* | Time-entity (irreversible) |
| *kali-yuga* | Time period of 432,000 yrs |
| *kaaran* | cause: *nimitta-kaaran* (efficient-cause), *upaadaan-kaaran* (material-cause), *saadhaaran-kaaran* (ordinary-cause) |
| *kaarya* | effect, action, karma |
| *Krishn or Krishna,* | or *Shree Krishn, Yogiraj Krishn*: All names of Lord Krishn who delivered the message of Bhagvadgita to Arjun |
| *maatali* | cosmologist, a sage with specific knowledge of creation, space, time and cosmos |
| *Mahabharata* | War between Kauravas and Pandavas near 3,140 BCE, an epic book |
| *mantra* | A metered poetic couplet |
| *Manu, Manusmriti* | Manu the first ancient king of Aryans who wrote the book of Manusmriti |
| *Munn* | Mind-entity |
| *Nirukt* | Book by ancient Rishi Yask |
| *nitya* | ever-existing |
| *paramanu* | fundamental particles of matter indivisible further, round in shape |
| *pari-kraman* | defines the 'step-wise motion on a circle' |
| *Prajapati* | Nature the master of cosmos (material realm), God as the master of all cosmos (spiritual context) |
| *Prakriti* | Nature |
| *pralaya* | dissolution of creation |
| *paryaplavan* | large scale circular rotation around an axis of a system in floatation as in hurricane |
| *rishi* | a highly enlightened person, revealer of Veda mantras and the hidden meaning in them |
| *Sarasvati* | a multi-meaning word: intellect, ancient extinct river, title for a Vedic scholar of high calibre |

| | |
|---|---|
| *Sata-state* | real definable matter, the state of matter to form universe |
| *sato-guna, rajo-guna* and *tamo-guna* | fundamental *aapah* particle made up of three different particles with three properties (*guna*) (details in Chapter 5) |
| *Sanskrit* | A highly developed, grammar-rich ancient language, the language of the Vedas |
| *skambha* | Pillar, support of the universe (Creator, physical structure of matter and energy at universe's centre |
| *sneha* | property of bonding matter or living-beings |
| *srishti* | Creation, one that does not happen by accident |
| *sukta* | group of mantras with common theme, a hymn, section of a chapter |
| *Sutra* | treatise, a book of philosophy |
| *sutra* | an aphorism, a principle |
| *swami* | master, highly revered person, a monk |
| *tatva* | substance with real existence, entity |
| *tuchchhaya* | space holding universe in dissolution phase in diminutive space when matter is in devoid of dynamics and properties |
| *urmim* | vibrations or waves |
| *Vedas* | The books of knowledge, four Vedas are RigVeda, YajurVeda, SaamVeda and AtharvaVeda |
| *varootham* | Cluster of atoms (a cosmic objects) |
| *vitatah* | (विततः ): instantaneous expansion as in an explosion |
| *yojan* | Ancient unit of distance (1 *yojan* = 13 km) |
| *Yudhishthir, Arjun* | Two of five Pandava brothers in Mahabharata |

# About the Book

Could there be another rational cosmology theory elsewhere in another civilization before the modern Big Bang was conceived by Georges-Henri Lemaitre in 1927 CE. Yes there is. It literally exists since antiquity, in 'chapter-and-verse', in the book of RigVeda, encased in eons old mantra formulations under the heading of *Bhavavrittam* which means "*The History of Creation of the Universe*". The author, Dr. Shiv Raj Pal a physicist, named the process the "Vedic Big Bang" because the universe in Vedic Cosmology begins with an impetuous explosion in the enormous primordial matter ovate termed *Hiranya-aand* (brilliantly hot Golden-spheroid). It is amazing that these two cosmologies, eons apart, are similar in some aspects and different in others. The uniqueness of the Vedic Big Bang is that a colossal rotating central-bar (pillar) of matter/energy initiates the Big Bang and sustains the universe in perpetual rotation and expansion in which the matter, energy and all physical processes are real and none hypothetical such as the hypothetical Cosmic Inflation and Dark Energy of the modern Big Bang.

The Vedic definitions of Time, Space and Nature (matter, energy) are superior and detailed. The Vedic Cosmology Scenario is followed by the Vedic theory of the formation of the solar system revealing intriguing features of the planets. The book takes the reader to India's historical period anterior to 5,000 years when the rich Vedic Literature was developed. Mind-boggling deductions from the mantras indicate an incredibly elevated thought-system prevailing in the Vedas. Prepare for an illuminating voyage to the beginning of the cosmos.

# About the Author

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# THE VEDIC BIG BANG

## A New Cosmology Scenario Revealed in the Ancient Veda Mantras of India

VOL 2

**Shiv R. Pal PhD (Physics)**

# The Vedic Big BanG ©

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## VOLUME 2 (Chapters 6 to 11)

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# Table of Contents

## VOLUME 2


**About the VOLUME 1**
**Preface to the Vedic Big Bang**
**Acknowledgements**
**CHAPTER 6: The Vedic Cosmology Principle**
- Vedic Cosmogony: The Bhavavrittam Sukta of RigVeda
- The Vedic Cosmology Principle – *Asata* to *Sata* state of Matter
- Creator Energy Field: The Supreme Consciousness
- The Vedic concept of *Devas* - the Energy Fields
- Commentary on the *Bhavavrittam* (Creation) *Suktas* of RigVeda
- Manusmriti and Vedic Cosmology Principle

**CHAPTER 7: The Energy Forms in the Vedic Big Bang Scenario**
- *Tuchchhaya* (diminutive) versus Colossal Space-entity
- Hidden Dynamics in the Compact Hydrogen Universe
- Vedic Creation begins at True Absolute Zero Temperature
- Higgs Particle or God's Particle and the Vedic Perspective
- *Indra-devata* - the Electricity

**CHAPTER 8: First Action of *Aditi* (Nature) – the Creation of the Eight Progeny of *Aditi***
- Cosmic Dance of *Aditi* (Nature)
- *Maartaand* (primordial Brilliant-ovate) prepares for the Vedic Big Bang
- The Seven Primary Vedic *Devas*
- Matter distribution between the *Devas* and the Observable Universe

**CHAPTER 9: Heat Energy $E_h$ and Rotational Energy $E_r$ are the Fundamental Tools of Creation**
- Rotational Energy $E_r$ Creates a Rotating Universe
- Concept of Dark Energy Hypothetical and Unnecessary
- *Skambha* the Pillar of Energy
- Expanding Universe - a Vedic Discovery Eons Ago

The "Vedic Cart-wheel Universe" favours the Five contemporary Cosmology Principles
Expansion of the Universe: Big Bang Hypothesis versus Vedic Big Bang Scenario
Shape of the Universe in Vedic Literature
Consequences of the Rotation of the Universe around an Axis
(1). Dark Halo Surrounding the Galaxies
(2). Dark Matter Mystery
(3). Furrows in the Aapah Field- The Mirage of the Cosmos
(4). Curved Space near massive bodies has a Different Meaning
**CHAPTER 10: The Vedic *Pralaya* (dissolution) is the Big Crunch**
*Rajo-Guna* - the Gravitation Leads to the *Pralaya* (dissolution)
Important Deductions from Chapters 7 to 10:
**CHAPTER 11: Functioning Vedic Universe –Birth of the Solar System and the Ancient Observations of the Sun and the Planets**
Vedic *Nakshatras*: the Constellations
Formation of the Solar System
Vedic Distinction between the Sun and the Planets
*Soorya*: the Sun
Etymology of the Vedic Names of the Sun
*Aapah* the Fuel of the Sun
Mercury: the planet *Budha*
Venus: the planet *Ven (Shukra)*
*Prithvi*: the planet Earth
Synonyms of *Prithvi* (Earth)
Origin of the Earth
The Earth in the Vedas is not the Centre of the Universe
The Earth according to the Vedas has Grown Bigger
Three Motions of the Earth
Earth's Gravitation: Veda and Vaisheshik Darshan
Vedic Origin of the Moon
A mind-boggling Vedic deduction about the Lunar Surface
Mars: the planet *Mangal*
Jupiter: the planet *Brihaspati*
How was Jupiter named *Brihaspati* (biggest in planets)?
Jupiter the Dyu-pitar of Vedic Literature

Saturn: the planet *Shanaishchara* (slow-moving)
Comet: the *Dhoomketu*
**Index**
**References/Citations**
**Limited List of Vedic Terms often cited in the Book**
**About the Book**
**About the Author**

# About the VOLUME 1

Usually one does not expect to find a meaningful science thought in ancient texts, leave alone finding well laid out cosmology. The fact is that the ancient Vedas, known as the "*knowledge books of the Aryans (Hindus)*" are inundated with the mantras delineating physics processes, principles and the stages of Nature (matter) from the fundamental particles to the birth of the solar system.

In Chapter 1 the reason for the title of the book is given and examples of the "Mind-boggling Cases in Vedic Physics" are presented. Using the Vedic references the subject matter is elaborated under several sub-headings such as: "Modern Concepts of Nature, Time, Space and Big Bang are Ancient", "Rotating and Expanding Universe an Ancient Vedic Thought", "Earth in the Vedas is Spherical, in Motion and Not the Center of the Universe", "Earth's Gravitation - a Vedic Concept". Interesting discussions on "Hawking and the Universe Out of Nothing" and "Hawking and the Grand Design" are included.

Using simpler terminology the modern Big Bang Hypothesis is discussed in Chapter 2 and its premise is critically examined. Several questions are raised such as – why is the speed of matter during the Cosmic Inflation era over 3,000 billion-billion times the speed of light? To prove the author's "Reference Hypothesis" which is that - ***"The Vedic references on cosmology are ancient and precede 5,000 years",*** a multi-pronged research in Vedic Literature and in Vedic History was undertaken. In Chapter 3 the author establishes the validity of a milestone in Indian history at 3140 BCE which is concomitant with astronomy.

The four Vedas, their voluminous Brahmana Commentaries and the main branches of the vast Vedic Literature are tabulated in Chapter 4. The Chapter 4 is a source of knowledge and information pertaining to the ancient Vedic Literature generated by the Vedic *rishis* (sages) in the far antiquity of the milestone at 3140 BCE. The Chapter 4 deals with the subjects under the sub-headings: "Categories of Vedic Literature", "The Vedas", "The Meaning of the term Veda", "Sanskrit: A Language with the Scientific Structure", etc.

The Chapter 5 provides the definitions of the entities that partake in the advent of the universe. The sophistication in these definitions at times

exceeds that in the modern Big Bang Hypothesis. It also presents the Aryans' Time division beginning from 4.32 billion years to a *nimesh* measuring 0.17778 seconds. The chapter presents several mind-boggling ancient physics examples. The titles of the five Chapters in VOLUME 1 are as following.

# Chapter Headings of VOLUME 1

CHAPTER 1: Introduction to Vedic Big Bang. .....1
CHAPTER 2: Present Understanding of the Universe – a Critical Scrutiny of the contemporary Big Bang Hypothesis…….....75
CHAPTER 3: The Historicity of Vedic References - the References on Cosmology Precede 5000 years…….....…131
CHAPTER 4: A Brief Review of Ancient Vedic Literature – the Source of Ancient References on Cosmology…….....….221
CHAPTER 5: The Primary Vedic Entities in the Creation of the Universe..... 299

To

**my wife and our son - my best friends.**

# Preface to the Vedic Big Bang

Professor Carl Edward Sagan in his writings and in the famous TV series, 'The Cosmos', praised ancient Vedic thought on cosmology. He recited the English translation of a Veda mantra and remarked, '*most sophisticated ancient cosmological ideas came from India*'. I have attempted to bring together the advanced, intriguing cosmological ideas from a large number of the ancient Veda mantras that lay the foundation for a Vedic Cosmology Scenario for the formation of the universe. My humble effort would further strengthen Carl Sagan's enunciation. Of the wide range of subject areas covered in the Vedas, the emphasis in my book has been restrained to invoking the mantras relevant to physics and the Vedic Cosmology Principle that reveal the process of the formation of the universe. All this hidden knowledge permeates the ancient Veda mantras.

When I began writing this book in 2008 there were no modern books addressing Vedic Cosmology from a physics perspective. It took me many years of intense Vedic research and cosmological analysis to complete this book entitled "The Vedic Big Bang". I therefore chose thorough, comprehensiveness rather than speed of publishing.

This author (Shiv R. Pal) named the Vedic creation process "**The Vedic Big Bang"©** because it sets forth the birth of the universe out of an impetuous explosion in the enormous primordial ovate of brilliantly hot matter named हिरण्मयमाण्डं (*hiranmayam-aandam*) the literal meaning of which is – "the golden-embryo" or "the ovate/spheroid with hot golden brilliance". There are several similarities and numerous differences between the ancient Vedic Cosmology Principle developed in Chapter 6 and the Big Bang Hypothesis in modern cosmology; both separated by a time-gap ranging in millennia.

An overview of the status of contemporary cosmology with an emphasis on the Big Bang Hypothesis is presented in Chapter 2 in simple terminology at the level of a general reader. This author raises numerous questions on the enormity of the explosion in a dimensionless point called

the 'space-time singularity' at infinitely high temperature. The 'universe out of nothing' from the dimensionless space-time singularity is counter intuitive and in violation of the simple logic affirmed by the ancient *sutra* (1/43) - नावस्तुनो वस्तुसिध्दिः (*Naavastuno vastusiddhi*) of Rishi Kapil's Saankhya Darshan (Philosophy) which means - "*Nothingness cannot be the cause of something"*. The contrasting Vedic Big Bang mechanism uses the pre-existing indefinable *Asata*-state of matter (Nature) as the "material-cause" of the real definable *Sata*-state of matter that forms the universe. The universe is the ensuing 'effect' of the pre-existent "material-cause". The Vedic Big Bang is 'something out of something'. This book presents a new perspective on the deficiencies of the modern Big Bang Hypothesis including the mathematical exercise in the hypothetical Cosmic Inflation to accelerate the universe and the un-harnessable Dark Energy to expand it. One of the Big Bang theory's creators, Paul J. Steinhardt of Princeton University (USA) stated (Scientific American, April, 2011) – *"....But some of the theory's creators ....are having second thoughts. As the original theory has developed, cracks have appeared in its logical foundations....."*

The Vedic Big Bang Scenario in Chapters 7 to 9 is not translated into a mathematical framework, however, this Veda-based qualitative scenario works with real physical entities, real physics processes and the real by-products of matter and energy, including the force responsible for the expansion of the universe (discussed in Chapters 8 and 9) unlike the hypothetical Dark Energy in modern cosmology. Developing a mathematical model of the Vedic Big Bang would be straightforward when taken up.

This author, a physicist by training, found in his Vedic studies a treasure-trove of mantras laden with the principles and mechanisms pertaining to the advent of the universe and also found thoughts rich in the cognate subjects including physics, cosmology and astronomy. The four Vedas: RigVeda, YajurVeda, SaamVeda, AtharvaVeda, known as "*the books of knowledge of the Aryans***"*, are the fountain-head of the mantras. Sanskrit, a language with perfect grammar, is the language of the Vedas and the subsequent Vedic Literature. Each term (word) in Sanskrit is a derivative of a root or roots, the etymological analysis of which yields the meaning of the term and reveals the properties and nature of the entity the term stands for. The term "*arya*" originates from the Veda. In spiritual context it means the *eeshwar-putra* (progeny of God) and in the social

context it means "*a person with noble qualities*". From ancient times the inhabitants of the Indian sub-continent have been known as 'Arya' and the sub-continent has been known as 'Aryavart' (the place of the Aryans**). The term Hindus for the Aryans of India and the term Hindustan for Aryavart is a later identification owing to invaders from outside India.

Utilizing the vast Sanskrit vocabulary the Vedas are composed in mantra formulations in unique and mathematically perfect metered poetry. That itself is mind-boggling. The RigVeda alone has 10,521 mantras in it, grouped into 1,028 *suktas* (hymns or sections) with 209 *devatas* (subjects) credited to 354 *rishis* (sages), among whom are 21 *rishikas*, the female *rishis* (Ved Shastra Talika, by Pundit Jiyalal Varma, 1958).

Based on 12 RigVeda mantras from the "*Bhavavrittam" sukta* and 5 *shlokas* of Manusmriti from its first chapter on "Birth of the Universe", this author (Shiv R. Pal) developed the "Vedic Cosmology Principle" in Chapter 6. From these mantra references, the author draws 28 physics deductions. These deductions with the additional 40 mantra references enabled developing the Vedic Cosmology Scenario in Chapters 7 through 10. The *rishi* (sage) appropriately entitled the RigVeda *sukta* (hymn) as the '*Bhavavrittam*' because the term (discussed in Chapter 6) means "*The History of Creation of the Universe"* or "*A description of the Birth of the Universe*".

This author has further strengthened the foundation of this unusual book on ancient cosmology by complementing the mantra references with the *sutras* and statements from the precious ancient Vedic Literature (Darshans, Smritis, Upanishads, Brahmana books and so on); all anterior to a time-milestone on February 18, 3102 BCE. The book presents the etymology of the important terms in Vedic cosmology, leading to the fundamental definitions of entities serving as a 'cause' in the formation of the universe.

The author takes several steps for translating mantras from Sanskrit to English. A mantra is first presented in *Devnagari* script (the name of the Sanskrit script) followed by its transliteration. After separating conjugated words, all the words of the mantra are listed with etymological root-based *yaugik* meanings, keeping in mind the context of the *sukta* (hymn) and the mantra. Then, following the instructions emphasized by Swami Dayanand Sarasvati (1825-1883 CE) in his interpretive translation of RigVeda and YajurVeda in the Hindi language and the etymology of terms in the book of

Nirukt by Rishi Yask, this author presents the composite mantra translation in English. All Sanskrit terms in the book are italicized. The Vedas being theistic, at times the mantra gives credit to the "efficient-cause", the Creator, for a physical phenomenon in the "material-cause", the Nature. This is reflected in the mantra translation. However, even if the Creator is separated from the subject matter of the mantra, the valuable physics lesson of the mantra still persists.

The major participating entities in the Vedic creation process of the universe such as Time (*Kaalah*), Space (*Antariksh*), Nature (*Prakriti*) and so on, including the definition of the fundamental building-block of *Prakriti* (Nature), the smallest unit of matter termed as *parmaanu*, are all defined with clarity. The Nature in the Vedas is an inert entity without the virtue of inspiration to create. It is the entire matter/energy of the universe; the universe is the Nature. The Nature in Vedic physics, at its most fundamental level is divided into a triplet of fundamental particles named *sata*, *raja* and *tama* with diverse properties. All definitions are in Chapter 5.

The abstract entities, Time (*Kaal*) and Space (*Aakaash*), are thought to be real entities in the Vedic Cosmology, same as in the modern Big Bang cosmology. The difference is that these entities in Vedic Cosmology are eternal in nature through the perennial cycle of creation-dissolution of the universe whereas in the modern Big Bang Hypothesis they are said to be first-time created at the time-zero of the Big Bang. They are used in the Big Bang algorithm but are least defined or not defined in terms of what they actually are, what mechanism created them with what ingredients and what is at their fundamental structure.

A general principle in Vedic Philosophy stipulates that all created entities are quantized at their fundamental level. Therefore, the onus is on the modern Big Bang Hypothesis to define the entity being used. The mantra formulations in Vedic Cosmology render considerable commentary on the nature of these entities (discussed in Chapters 1 and 5, Volume 1). The entities such as the Time (*Kaal*) and the Space (*Aakaash*) are common to the two cosmologies; however, one finds that their Vedic definitions are superior in uniqueness and depth to the definitions available from the modern cosmology. The large number of Vedic synonyms for these entities represent their specific properties and add to our understanding of the uniqueness of these entities. The specificity in a Vedic thought at times is mind-boggling. It is mind-boggling to read in the RigVeda mantra (10/56/5)

that the universe is expanding. The full mantra is in Chapter 9 in Volume 2, however when one reads that the universe with *"…its self-propelling force expands greatly the celestial objects from their minimum positions ….in togetherness ….*" one has no choice but to put such mantras into the physics frame of reference. In the Vedic mechanism the force of expansion is real and not hypothetical as the un-harnessable Dark Energy of modern cosmology.

The Sanskrit term for the advent of the universe is '*srishti*'. The closest term for '*srishti*' is 'creation'; the etymological analysis signifies that the term '*srishti*' has no religious connotation and stands for the advent of the universe with all the substances created in it, animate and inanimate. It has no relation to the creationist-argument. Implicit in the term '*srishti*' however is that "*the universe is not an ever-existing phenomenon, it has come to be at a given point in time*" and its active state of matter during the creation phase will dissolve into an inactive state leading to its non-creation phase termed as '*pralaya*'. In the Vedic thought the '*srishti*' and '*pralaya*' are part of the eternal cycle with long-term frequency; they are the day and night of the creation-dissolution process.

To prove that the Veda mantras and the *sutras* of Darshans are extremely ancient and were not influenced by the modern thought and by the thoughts of other known ancient civilizations the author postulated a 'Reference Hypothesis' in Chapter 3 stating, ***"The Vedic references on cosmology are ancient and precede the* 5,000*-year period"***. The hypothesis is proven by establishing a realistic timeline deduced from the historicity of Vedic Literature and validated by the ancient records available even today in three different calendars that have been in active use since India's distant past.

The antiquity of the Vedic references used in this book takes one anterior to the time-milestone at February 18, 3102 BCE, which was not established by a common calendar initiated at the coronation of a king or introduced after a famous person in history but it marked the onset of a calendar that is concomitant with astronomy. This date in the Common Era Calendar is the onset of the Vedic sub-Calendar called the Kaliyug-Calendar within the Vedic Srishti-Calendar (long-term Natural Vedic Calendar).

This book provides a glimpse into the ancient Vedic civilization in India going past 5,000 years. The overview of the Vedic Literature in

Chapter 4 exhibits its richness. The religion, science and philosophy go hand-in-hand with the concept of the form-less unitary all-pervading consciousness *Brahmn* as the Creator, with the inert *Prakriti* (Nature) serving as the material-cause of the universe. In addition to the conterminous Creator and the quantized Nature, the universe is also populated with the quantized units of consciousness called the *aatmas* (souls) whose interaction with matter is observable in the living-beings bound by the principle of free-will, karma and the system of re-birth.

The brief historical overview of the Vedic Civilization presented in Chapter 3 begins with the kings of the Sun Dynasty in the distant past of the time-milestone in 3102 BCE who ruled from Ayodhya including King Ram. The kings from the Moon Dynasty ruled from Hastinapur (Delhi). This book gives information about the years, months and days of rule of each king in the Lunar Dynasty, starting from the coronation of the King Yudhishthir in 3140 BCE after the great war of Mahabharata. The Aryan dynasty at Hastinapur continued till 1191 CE when the last Aryan King Yash Pal was forcibly replaced by a Moslem invader from outside India. Parallel to Yudhishthir dynasty was the Nand dynasty of Kashmir kings. The historical account is compiled in the book entitled "Raj Tarangini" written in 1148 CE by the court historian Kalhan. The remarkable continuity in the succession order of the head-priests at Shankaracharya monasteries, beginning in October 492 BCE, is available in three different ancient Indian calendars up to date. These data provide the proof for the Reference Hypothesis stated above.

Max Muller and the other Western Indologists of the nineteenth century, who translated the Veda from Sanskrit to English, arbitrarily shrank and distorted the ancient history of India without providing a solid reference in support. This assault did not spare even the Vedas and the Vedic Literature. That erroneous history is still being taught by the contemporary scholars. Therefore, the Chapters 3 and 4 in Volume 1 of this book are critical of Max Muller. His inadequate preparation in the Sanskrit language and grammar and his bizarre mistranslations of the RigVeda mantras are pointed out. The writings of Max Muller's contemporary Swami Dayanand Sarasvati and Pundit Gurudatta Vidyarthi, the great scholars of Sanskrit, are invoked to point out erroneous mantra translations by Max Muller and others. To disprove Max Muller's Aryan Hypothesis and the Aryan Invasion Theory, the author has tied some historical loose ends invoking the

state-of-the-art data from satellite and ground-truthing instrumentation under the "Extinct Sarasvati River Project" and the national genome projects of the Government of India.

Sooner or later this unique book was to happen because when a contemporary physicist (like this author) reads in Rishi Kanaad's ancient Vaisheshik Darshan *sutra* (5/2/3) - अपां संयोगाभावे गुरुत्वात् पतनम् (*Apaam sanyog abhaave gurutvaat patnam*.), which means - "*The rain drops in the absence of the union* (*with air*) *fall down due to* ***gurutva*** (gravitation)", this author has to let the underlying fact be known to all, that the knowledge of gravitation (***gurutva***) is far more ancient than 1666 AD when Newton may have seen the apple fall from a tree. The inescapable fact is that Rishi Kanaad's statement on gravity is neither a fortuitous one nor a fleeting one because, to explain the intended phenomenon of gravitation at a deeper level of inquiry, he took up two other examples from the daily life, exhibiting the effect of gravity. The first example was that of a *moosal* (heavy pestle) falling in the *okhal* (mortar) under gravity (5/1/7) when released by hand. The second example was that of an arrow in-flight with the additional force imparted to it by the string of the bow, falling gradually under gravity (5/1/16, 17, 18). He also emphasized gravity as the अदृष्टकारितम् (*adrishtkaaritam,* 5/2/1, 5/2/2) of the Earth, the invisible action (karma) of the Earth, an erudite deduction indeed!

The Vedas are not just focused on cosmology. They deal with considerable astronomy beginning with the mantras on the formation of the solar system (Chapter 11) and the meaningful naming of the 28 constellations and 9 planets; the Earth and the Moon included. The Vedic prescribed solar system formation is quite similar to one of the modern theories of the formation of the solar system. The *rishis* had developed tremendous insight into the characteristics and orbital motions of planets. They named Jupiter as Guru, meaning '*the largest*' and Saturn as Shani – meaning '*the slow-moving*'. The seven rays of the Sun are given seven distinct names and the Sun is designated as the controller of the solar system. Considerable discussion is presented on the Sun, the Earth and the Moon. The mantras state that the Earth and the planets orbit around the Sun and the Earth is round and not the centre of the universe. A mysterious statement in the Mantra Brahmana (1/5/13) states - '*That black substance on the surface of the Moon is there from the interior (heart) of the Earth*'. It

is astonishing that the modern astronomy has not yet suggested the Earth's interior as the source of the black-maria regions of the Moon, predominantly on its front surface facing the Earth. Based on the age estimates of the lunar samples, this author has explained the possibility of the veracity of the Mantra Brahmana statement.

When a Veda mantra assigns a definite period of 4.32 million years for the primordial matter-conglomerate of the universe in the ovate shape (*Hiranmaya-aandam*) to have developed tremendous heat energy and rotational momentum before it exploded (Big Bang) creating *koti-koti* (hyperbole for uncountable) smaller *aandams* (ovates), which are said to be the cause for the *mahaan* (great) celestial bodies, a physicist cannot label such a mantra as the byproduct of faith. The number 4.32 MY being in cosmological scale and associated with the raw material of the universe in the shape of a brilliantly hot spheroid (*Hiranya-aand*), he has no choice but to put the mantra into the physics realm. The mantra thus is a part of the Vedic Cosmology Scenario.

## Mind-boggling Cases in Vedic Physics

In the development of the Vedic Big Bang Scenario several deductions are drawn. It makes one wonder how the *rishis* (sages) of the Veda mantras reached such conclusions in physics, so long ago. Of the numerous mind-boggling cases found in the Vedas and discussed in this book, two are cited here that have strong relationship to physics.

Rishi King Manu in his book entitled Manusmriti has divided the time-scale from the largest time-unit of 4.32 billion years to the smallest time-unit of *nimesh* (178 milliseconds). A *nimesh* being the blink-time of a human eye, Manu could not have derived this unit without a rigorous experiment in human physiology and an accurate time measuring methodology. The state-of-the-art blink-time measuring experiments carried out by other researchers (discussion in main text) with computerized timing with the optical imaging system, provided the average blink-time of a normal human eye to be 175 milliseconds. This is very close to Manu's definition of *nimesh* measuring 178 milliseconds. This is not an ordinary result.

The RigVeda mantra (1/123/8) states that the distance of morning twilight illumination due west of the sunrise point is 30 *yojan* (390 km).

This is mind-boggling because using the ray-tracing geometry and knowing that the troposphere contributes to twilight, one finds that 390 km is highly accurate (details in Chapter 5). It is mind-boggling because it could not have been determined without the *rishi* having the knowledge of the daily spin rate of the Earth and its circumference and radius. These cases are amazing because all this took place anterior to the time-milestone at 3140 BCE!

**Shiv Raj Pal**

# Acknowledgements

Acknowledgement by an author of a book is generally about expressing indebtedness to those who have played a role, directly or remotely, in helping to enhance the substance of the book. About indebtedness, the ancient commentary book on YajurVeda, the Shatpath Brahmana states (1/7/2/1), - "S*oon as a human-being is born he/she is indebted to the devas, rishis (sages), pitars and the other humans of the society*". The *devas* in this context are the inert physical systems of Nature, that are essential for sustaining the universe and 'selflessly' enabling the living creation in it. Just by the virtue of taking birth in this creation a human-being becomes indebted to Nature (*devas*). The Veda advises humans to become conscious of the environment and refrain from misusing and harming the Nature's systems. Conserving Nature's resources and minimizing wastage are the payments towards the debt the humans owe the *devas*.

Humans are indebted to the *rishis* (sages) who selflessly impart Vedic knowledge through the Veda mantra formulations. This author is indebted to the Vedic *rishis* for the mantra formulations in the four Vedas and the *sutras* in the Darshans (Philosophies), Upanishads and Smritis that form the basis for the physics and cosmology in this book. The author is especially grateful to Rishi Swami Dayanand Sarasvati (1825-1883 CE), the great scholar of Vedas and the Vedic Literature who revived the interest in the Vedas and gave an impetus to the society to be proud of the Vedas and the Vedic knowledge. He emphasized to use the right tools of grammar and methodology for understanding, translating and interpreting the Veda mantras. The author has benefitted immensely from his Veda translations in the Hindi language and his guidance for unravelling the meanings of the mantras using the '*science of word formation*' in Rishi Panini's *Ashtaddhyaayi* grammar and the ancient etymology of Vedic terms in Rishi Yask's Nirukt and Nighantu. Utilizing the Veda mantra references this author has become increasingly aware of the irredeemable debt that he owes to the Vedic *rishis*.

The author wishes to express his gratitude to the late Pundit Jiyalal Varma of Kota, Rajasthan, the author of a Vedic resource book entitled

"Ved Shastra Talika" ("A Key to Vedas and Philosophy") who was a mentor to this author for the Vedic knowledge. Pundit Jiyalal ji discussed with the author the intricate concepts of Vedic Philosophy when the author was of an impressionable age during his school, college and university years while pursuing education in physics. In 1961 Pundit Jiyalal ji from his large book collection gifted to this author a book entitled "Ved Vidya Nidarshan" written in 1959 by Pundit Bhagvaddatta and asked this author to read the book and explore the science thought in the Vedas. The author cherishes this inspiring book and has referred to it in several places in this book.

The author is grateful to Acharya Udayaveer Shastri (1894-1991 CE), a great Vedic philosopher of our times, a great Vedic historian and a scholar of Sanskrit language, with a large number of books to his credit, for his interpretations of the mantras and the *sutras*. Referring to the historical data arduously researched and presented by Acharya Udayaveer Shastri in his remarkable book entitled "Vedant Darshan Ka Itihaas" (History of the Vedanta Darshan, 1991) has tied some historical loose-ends for this author's "Reference Hypothesis" (in Chapter 3). Deep gratitude is expressed to the late Acharya Gyaneshvar ji of the Vanprasth Ashram of Rojad, Gujarat, who generously gave his time for discussions on Vedic topics.

Humans are indebted to the *pitars* (parents and forefathers) because they contributed to establishing a civilized society. Under the Vedic karma principle and the rebirth system one is considered to be blessed if one takes birth from 'good parents and in highly developed society'. My parents are the *pitars* who followed their *dharma* towards the society they were born into and brought up the next generation with their best effort, responsibly. I am indebted to my late parents.

Even though my parents were unsophisticated village folks with education at a basic reading-writing level, they had high reverence for education. Not having a school in my small farming village and discovering that I had the potential for acquiring higher education, my parents left no stone unturned to walk me to a school wherever possible in the countryside even during monsoon rains and hot summers. Poverty did not stop my determined parents to send me to the city for education at the primary and middle-school levels. The well-deserved educational scholarships and the small income from the private tuitions that I offered in the community, made my continued education viable, unburdening my parents from the financial strain.

I am deeply grateful to my parents for inculcating the values and the discipline that took me forward, step by step, through successes and setbacks. Their words of wisdom disguised in the form of a simple 'village-saying' or an ancient proverb have left an imprint on my inner-self and the same words echoed different meanings under differing circumstances of life. When I was small and walked by my father's side he told me: "*Shiv, there are two possible benefits of looking at the ground ahead of you while walking rather than looking at the sky; you may find a rupee* (money) *and you will never step on a snake*". Their simple words of wisdom always had a much deeper meaning. I will remain indebted to my parents.

My wife, a Ph. D. from the University of Toronto, a Special Educationist, kindly accepted my request to edit the manuscript. A talented singer with the music degree of Sangeet Visharad in North Indian Classical Music, with three albums to her credit, she is generous with her time and teaches meditational music on a voluntary basis at a charitable cultural institution. With her busy schedule she devoted valuable time to help refine the manuscript. I am grateful to her for spending uncountable hours on editing and for continuing to be a tower of strength for the family.

After retiring from research in physics, I spent considerable time on the studies of the Vedas and Vedic Literature. Based on my notes I prepared several public lectures and discourses. Our son helped me with the logistics of the presentations. He encouraged me to compile the Vedic ideas and the copious notes into this book. I am grateful to him for his persistent encouragement which led me to write this book. He has closely followed the progress of the book and was always helpful in resolving any technical difficulties. He has been a steadfast friend through all the challenges that I faced.

**Shiv R. Pal**

कालो ह भूतं भव्यं च पुत्रो अजनयत् पुरा ।...

(*"Kaalo ha bhootam bhavyam cha putro ajanyat pura"….*)

*"Time (Kaal) the son is its own father* (the past) *and will be born as its own son* (the future)"….

(AtharvaVeda, 19/54/3).

# CHAPTER 6: The Vedic Cosmology Principle

Many *suktas* (hymns or sections) and individual mantras in the four Vedas relate directly or collaterally to the subject of the creation of the universe, but it is the *sukta* 129 of RigVeda' 10th *mandala* (chapter) with seven mantras in it that lays the foundation of Vedic cosmogony. This *sukta* (hymn) states the Vedic Creation Principle for the creation of the universe. The *rishi* of this *sukta* is Prajapati Parameshthi and the *devata* (subject) of the *sukta* is *Bhavavrittam*. The composition of these seven mantras is in three differing *chhandas* with the metres of the couplets being respectively *nichrit-trishtup* (1 to 3 mantras), *trishtup* (4 to 6 mantras) and *paad-nichrit-trishtup* (7th mantra). The singing note of the *sukta* is *dhaivat*, the 9th note of the regular Vedic scale of 12 notes which is equivalent to the note A of a modern piano. According to the ancient note division of 22 *srutis* of the music scale, the singing note *dhaivat* of the *sukta* is the 18th note of the 22 note scale. The name of this note is *madanti*.

# Vedic Cosmogony: The Bhavavrittam Sukta of RigVeda

The term *Bhavavrittam*, assigned by the RigVeda for the subject-matter (*devata*) of the *sukta* 129, is formed by conjoining two words - *bhava* and *vrittam*. The first word *bhava* means '*to come into existence*' or '*to happen*' or '*be created*'; all these meanings stand for the same process and all 7 mantras of this *sukta* contextually relate to *bhava*, the process of creation of the universe. The second term *vrittam* also stands for several closely related meanings such as '*the description of'*, '*the account of'*, '*the history of*', '*the report*' or '*the elaboration'*. Implicit in these meanings of the term *vrittam* is the universe, the creation history that is being presented by the *sukta*. These mantras make it abundantly explicit that their sole subject is **'***the description of'* the creation of the universe. When both terms, *bhava* and *vrittam*, are conjoined, the compound meaning of *Bhavavrittam* is "***History of Creation of the Universe"***. This is the *sukta*'s *devata* (subject) and it is not just an ordinary log of Rishi Prajapati Parameshthi - it is composed with the resolve to lay the foundation of the Vedic Cosmogony Principle. It depicts the process showing the continuity between the past state of the universe and its transition into the first steps of creation.

When one explores the beauty of the Sanskrit language within the *yaugik* perspective (root-based meaning of words) while analyzing the Vedic term *vrittam*, one finds other related meanings of this term in other realms. The *vrittam* in geometry and physics is a 'circle' because a circle in itself is a complete entity. The term *vrittam* in conjunction with the term *bhava* (*be created*) conveys the meaning - "*a complete account of creation*". A detailed description or a complete account of an event or history is generally expressed with a commonly used word *vrittaanta* derived from the term *vrittam*. The suffix conjugation *anta* to *vrittam* means 'up to the end'. Therefore the term *vrittaanta* means "*a complete account*".

The *devata* (subject matter) of the *sukta* 129 being *Bhavavrittam,* the "*History of Creation of the Universe"*, there are references in the mantras to several eternal entities including the Creator, however, the mantras in this *sukta* are not Creator centric and the emphasis is on the cause-effect and the

mechanism of the creation. There are a number of mantras in other *suktas* that also relate to the creation of the universe and cosmology in general. To discuss *Bhavavrittam* several other mantras with direct relevance to the physical aspect of the universe are subjoined to the *sukta* 129. These other mantras are from the *suktas* 130 and 190 of the *mandala* (chapter) 10 of RigVeda. The *devata* (subject) of these additional *suktas* is also *Bhavavrittam*. The discussion on the Vedic Creation Principle is further enriched by including several *shlokas* from the post Veda literature, especially from the ancient book of Manusmriti authored by King Manu.

Vedas generally do not deal with a subject in isolation. There are, at times, several subjects found associated with the main subject of a mantra. This is because several other seemingly detached subjects are in fact a part of the same creation. In a mantra therefore some specific subject, a specific principle, the entities and substances from the physical, metaphysical and spiritual realms could also be invoked. It is natural for RigVeda to invoke in *Bhavavrittam* the *anaadi* (eternal) entities, defined in Chapter 5, the *Purush* (Creator), *Prakriti* (Nature), *Aatmas* (quantized consciousness, the souls), *Kaal* (Time), *Aakash* (Space) and the transient forces and substances, physical and spiritual, that are part of the creation of the universe. It was emphasized earlier with regard to the Vedic creation of the universe that the participating entities, the process of creation and the benefactors of the creation are all an integral part of the purpose of creation.

Just as the Time-entity, Space-entity, Nature, particle physics, nuclear and atomic physics, electromagnetic radiation, Quantum Mechanics, astronomy and the other specific subjects are the *devatas* (subjects) of modern cosmology, the ***Bhavavrittam***, which means "***History of Creation of the Universe"***, is the *devata* of the *sukta* 129 of RigVeda's $10^{th}$ chapter. Within the *Bhavavrittam sukta* 129 alone are invoked a number of subjects, processes and concepts of physics. In fact this *sukta* sows the seed of Vedic Cosmology. When other *suktas* relevant to *Bhavavrittam* are invoked, one also learns about the Vedic perspective of cosmological events, processes and about the celestial systems and objects such as the *dyu* (brilliant intergalactic space), the Sun, the planets, the Earth and so on. These help evolve a picture of the Vedic-defined universe with realms, animate (pertaining to living-beings) and the inanimate (pertaining to inert substances) cooperatively connected and sustained. Based on the Vedic

Creation Principle developed in this chapter the picture of the universe in the inanimate realm is developed in Chapters 7 through 10 in Volume 2.

While the term *devata* is for a subject to be invoked in a mantra and used as a common noun, the term *devata* or *deva* is also used for a proper noun. Therefore, in a given context the term *devata* or *deva* applies to a specific physical system of Nature with specific properties that play a vital role in the creation, right from the very beginning till the end of creation. Thus, these first created *devatas* are part of the same Nature and are the Nature itself without which the matter's existence is not possible and therefore the existence of the universe is not possible.

The *sukta* 129 is also known as the *'naasdeeya sukta'* owing to the first compound word '*naasdaaseenno*' (नासदासीन्नो) of the first mantra in that *sukta*. In this author's opinion, as it will become obvious to the reader, the *naasdeeya sukta'* or the '*Bhavavrittam sukta*' has very little to convey on the subject of spirituality, however, the *sukta* has attracted much attention for its meaning, primarily in the physical realm and secondarily in the spiritual realm. This author has viewed all mantras of *Bhavavrittam* in a straightforward fashion where word-for-word meaning is presented without a metaphysical, spiritual or religious emphasis. The preexistence of entities and some correlative preconditions were defined in Chapter 5, which are a part of the process of the creation of the universe. These entities and preconditions will be treated here as participants in the process rather than subjects of worship. Of the seven mantras in the *Bhavavrittam sukta* the first three relate to the state of Nature before the onset of the creation.

At this point let us recall the discussion in the Chapter 4 on mistranslations of Veda mantras by some authors that still continue to float around, misleading a reader of the Vedic Literature. Any variance in the different translations of the same mantra would basically be due to the variance in word-meaning of the Vedic terms and on the level of Sanskrit grammar discipline adopted for those translations. The accuracy of a translation would depend on whether *yaugik* meanings (root-meaning) of the Vedic terms were used or plain *rudhi* (colloquial) meanings were extracted. The worst translations to be avoided are the ones that were arbitrarily conceived with mediocre vocabulary extracted from a limited Sanskrit dictionary without rigorous training in the Sanskrit language and the rules of grammar. This was emphasized sufficiently in earlier chapters. The translations of mantras in this book are based on *yaugik* meanings of

the Vedic terms, which is a precondition for translating Veda mantras. The latest reminder of this precondition in the Vedic etymology is in the book of Nirukt Sutra authored by Yask Rishi (>1900 BCE) and in the Nighantu, the ancient dictionary of specific Vedic terms. As pointed out in earlier chapters, the great Sanskrit grammarian and Vedic scholar Swami Dayanand Sarasvati (1825-1883), forcefully emphasized this precondition for mantra translation which was adopted by the Vedic scholars who followed in his footsteps but ignored by the Indologists and their followers. This author has based his English translations of mantras on the guidelines and translations from the Sanskrit language to the Hindi language provided by these Vedic scholars, including the translations of Swami Dayanand Sarasvati.

This author has kept away from the English translations of mantras based on *rudhi* Sanskrit adopted by Max Muller et al. and their followers. It therefore became imperative to provide detailed translations of Vedic terms in the mantras, word for word, that are crucial for understanding the formulations on the Vedic Creation Principle. This will enable the reader to compare and examine the validity of the thought behind a mantra. For establishing the Vedic Cosmology Principle, the *sukta* 129 of the *mandala* 10 of RigVeda is invoked in its entirety with full interpretation of all its mantras to reveal what according to the RigVeda existed before the onset of the creation of this universe and how it came to be. A mantra by its nature is a compact composition, at times requiring additional elaboration. Therefore, as it was done in earlier chapters for several other mantras, the final translation of each mantra of the *Bhavavrittam sukta* will be furnished based on the *yaugik* meaning of each term in that mantra with a full interpretation of the mantra itself.

The English translations of mantras by this author are his own and are based on the Hindi translations of the Vedic terms given by Swami Dayanand Sarasvati and are also based on the translations commissioned by the Sarvdeshik Arya Pratinidhi Sabha of India (Internationa Vedic Organization of Aryan Societies). The commentary on Saankhya Siddhanta (Hindi publ. 1991) by Acharya Udayveer Shastri and other books on Vedic Literature have also been great resources for these translations.

# The Vedic Cosmology Principle – Asata to Sata state of Matter

The four Vedic terms: *srishti, sarg, jagata* and *pralaya* that stand for the state of the universe in its different phases, were defined in the beginning of Chapter 5. The first mantra of *Bhavavrittam sukta* depicts the state of matter in the *pralaya* phase, which is the dissolved state of the universe. This state is opposite to the other three, the *sarg*, *srishti* and *jagata,* when the observable and functioning universe with dynamic cosmos is in existence. The first mantra of the *Bhavavrittam sukta* is in the following.

**RigVeda Mantra (10/129/1)**

**नासदासीन्नो सदासीत्तदानीं नासीद्रजो नो व्योमा परो यत् ।**
किमावरीव: कुह कस्य शर्मन्नम्भ: किमासीद् गहनं गभीरम् ॥

(RigVeda, 10/129/1)

**Transliteration:**

"*Naasdaseenno sadaaseettadaaneem naaseedrajo no Vyoma paro yat.*
*Kimaavreevah kuh kasya sharmannambhah kimaaseed gahanam gabheeram*."

**Word Translation:**

**(conjoined words separated according to the rules of Sanskrit grammar)**

न (*na*) = not that , असत् (*Asata*) = matter in its indefinable state , non-descript, not in existence, आसीत् (*aaseet*) = was, existed, नो (*no*) = not, सत् *(Sata)* = matter in definable state, in existence, आसीत् (*aaseet*) = existed, तदानीम् (*tadaaneem*) = before the *srishti*, before this functioning/observable universe, न (*na*) = not , आसीत् (*aaseet*) = existed रज: (*rajah*) = observable

matter / matter in particulate form / matter in atomic form / the cosmos/ energy, नो (*no*) = and not, व्योम (*Vyom*) = all-pervading, spread out space-entity, encompassing and protecting all, place for cosmos, पर: (*parah*)= beyond, in all directions, यत् (*yat*) = with those ।

किम् (*kim*) = what, आवरीव: (*aavreevah*) = covers, encompasses, कुहकस्य (*kuhakasya*) = of the darkness of fog, शर्मन् (*sharman*)= embedded in, अम्भ: (*ambha*) = ocean, water, किम् (*kim*) = why, आसीद् (*aaseet*) = exists, गहनम् (*gahanam*) = dense, गभीरम् (*gabheeram*) = deep ॥

Achharya Udayveer Shastri, the great Sanskrit scholar and author of interpretive commentaries of all six Vedic Darshans, translated this mantra in the Hindi language in his book "Saankhya Siddhaant" (publ. Vijay Kumar Govindram Hasanand, 1991) and provided a detailed interpretive discussion on the terms formulating the mantra. Based on his Hindi translation and based on the English translation of the terms presented above by this author, the composite mantra translation is presented in the following.

**Mantra Translation:**

"*Preceding the srishti (created universe), it is not that 'Asata', the indefinable matter was not in existence, it is the 'Sata', the real definable matter that did not come into existence. Then neither the 'rajah', the observable matter and energy existed, nor existed 'Vyom' the Space spread out yonder in all directions, the place for cosmos. What covers what was indeterminate when all was embedded in the gravid darkness of primordial fog. When nothing existed, then why would there be in existence the deep and dense ocean.*" (RigVeda, 10/129/1).

**Mantra Interpretation**

Are cosmos from eternity? What existed before the universe appeared? Did matter exist before creation? What created matter at time-zero of Big Bang? Did the universe have a cause? Did Space exist before the creation of the universe? All these questions are addressed by this first mantra of the *Bhavavrittam sukta* of RigVeda, the *sukta* on the "History of Creation of the Universe".

For defining the two fundamental states of matter, *Asata* and *Sata* respectively in two successive phases of the universe, dissolution (*pralaya*) and creation (*srishti*), the first half of this mantra was introduced in the beginning of Chapter 2. Notice from the mantra's emphasis that the matter of the universe always existed before and after the onset of creation; the difference was in its state. Using two negatives (*not that 'Asata', the indefinable matter was not in existence*) the mantra emphasizes the existence of *Asata* that matter did exist preceding the creation of the universe making it clear that it was the *Sata* that did not exist then. The mantra completes the thought by associating the *Sata*-state of matter to the measurable and observable category of matter that the mantra termed as the *rajah*. While the first term *bhava* in the *Bhavavrittam* (History of Creation of the Universe) discussed above, represents the *Sata*-state of matter, one that has '*come into being*', it is the *rajah* form of matter that represents its 'effect' in the form of matter and energy that create the resplendent cosmos. The *Sata* is the active state of matter, one that has come into physical existence and therefore is definable as matter and energy.

Some scholars have interpreted the term *Asata* to mean '*maayaa*' (illusion) or 'nothingness' implying that the *Sata*-state of the universe is created out of 'nothingness'. The term तदानीम् (*tadaaneem*) in the mantra meaning '*before this creation*', the term तर्हि (*tarhi*) in the second mantra meaning '*at that time*' before the creation and अग्रे (*agre*) in the third mantra meaning '*preceding its existence'*, all imply that a time existed before the creation and a specific state of the Nature existed then. Other mantras in the *Bhavavrittam sukta* directly oppose the notion that the universe came into existence out of nothing. For example the 3rd mantra states that the universe becomes colossal starting from a *tuchchhaya* (diminutive) state. A diminutive state is relatively small but is not "nothingness". In the Vedic philosophy if there is an 'effect' it must have its pre-existing 'cause' because that is what is observed in Nature. Also the *sutra* in Rishi Kapil's

Saankhya Darshan (1/43), cited in Chapter 1, stated that नावस्तुनो वस्तुसिध्दि: (*Naavastuno vastusiddhi*) means - *"Nothingness cannot be the cause of something"*. Therefore, *Asata*-state of Nature before the onset of the creation is a reality and as the mantra states, it is the cause for the *Sata*-state which is the cause for the observable universe.

In modern physics it is the active form of matter that forms the observable matter of the universe, starting from the fundamental nuclear particles called quarks. It was explained in Chapter 2 that the diversity in matter is created by the existence of six types of quarks with differing properties coming together in differing proportions. If matter forming the universe was made of only one kind of quarks which did not react with each other, the modern physics probably would infer it but would not be able to sense it and would probably have no specific term for such an inactive matter. It could however be called the 'dark matter'. In the practice of modern physics, if something cannot be sensed, it may not even have an existence. The Vedic physics on the other hand gives due consideration to both, the inactive and active phases of the universe, by providing, albeit qualitatively, the terms *Asata* and *Sata* respectively, because for Vedic cosmology both have distinct separate existence.

Recall the discussion in Chapter 5 under the sub-sections on the Nature-entity, "Prakriti's Two-states: *A*sata and *Sata***"** and **"**Prakriti a Conglomerate of Tri-property Aapah Particles", that the *Asata*-state happens to be when matter's three properties *sata-rajah-tamah* are in a neutral, non-active uniform balance. This inactive state of matter is metaphorically compared to a dense fog in the mantra. The terrestrial fog is formed out of the humidity in the air. The humidity in the air by itself is transparent, however, under certain atmospheric conditions of pressure and temperature, the humidity begins to condense forming sub-micron size suspended water droplets causing a reduction in visibility. When the fog is dense, the landmarks disappear and the loss of directionality occurs. At the onset of the creation of the universe the undefined matter of the universe with indiscernible defining symbols and directions is compared to a dense fog-like condition. The primordial fog of matter is the state of matter referred to in the mantra. For the Vedic creation to start, a moment comes in the indefinable state of Nature when the balance in the three properties of its fundamental particles is disturbed making all individual *parmaanus* (fundamental smallest particles) active.

In Vedic thought the eternal entities during the creation and dissolution phases of the universe are real and play a positive role. In the created universe all created entities and substances that are invariant and transient, are also real, whether they are directly visible or observed through phenomena that they create or even remain invisible but affect some functions of the universe. In fact, the forthcoming chapters will reveal that with the exception of detecting many fundamental particles in modern physics, Nature in the Vedic creation creates several invisible fields and forces at subtler levels that are not part of modern physics. These subtle forces are not of an imaginary nature either. They function through the created matter in both its realms, animate and inanimate, binding the functioning universe together.

Whereas the modern physics deals exclusively with the physical forces of Nature that govern the properties and behaviour of the matter of the universe, without specifically recognizing what governs the consciousness, the Vedic creation recognizes the additional creation of certain subtler forces at the metaphysical level that, according to the Vedic philosophy, govern the matter under the jurisdiction of consciousness. The term *Sata* represents the matter of the universe that comes into existence. The term *sata* is not reserved only for the creation phenomenon; it is commonly used for what has a real existence. As an example, a substance or phenomenon sensed by any of the five senses in living-beings is said to be in the *Sata*-state. While the sense of seeing reveals the existence of substances with form and colours as the existence of *rajah*, the remaining four senses sense their subjects that are invisible and unobservable. Therefore, all energy forms, although invisible to the eye, are also in the *Sata*-state of matter and thus a part of the created universe.

A remarkable feature of matter according to this mantra is that matter does not change state from *Asata* to *Sata* in isolation; it needs the pre-existence of the *Vyom* which in the Vedas and the rest of the Vedic Literature stands for the Space-entity; which is Space in the modern cosmology also. The characteristics and importance of this eternal entity of the Vedic Creation was discussed in detail in Chapter 5. It was emphasized that the Space-entity of the Vedas is initially small but stretches to accommodate the created matter of the universe. By the time intelligent humans come to the stage of looking up and noticing the resplendent Nature, the *Vyom,* a real ubiquitous entity of the Vedas, is already spread out

well beyond their observation limit. An overwhelmingly large number of synonyms for *Vyom* (22nd in Table 5.6, Chapter 5), each expressing a specific characteristic and property, are available in Vedic cosmology. The term *Vyom* in the above mantra in particular highlights the property of pervasive vastness of the Space-entity. In the mantras that follow, it is indicated that the *Vyom* was initially confined in a smaller region (*tuchchhaya*) holding within it the *Asata*-state of matter. As expressed in the third mantra (RigVeda 10/129/3, to follow), the *Vyom* changes from small to vast in size along with the Nature-entity.

The statements in the mantras of the *Bhavavrittam sukta* are rich in terminology befitting the subject of cosmology. This would help establish the Vedic Cosmology Principle. With the help of other mantras from other *mandalas* and *suktas*, presented in the Chapters 7 through 10 in Volume 2 , a physical picture of the universe will unfold. Here it would suffice to say that at their fundamental level both states of matter, *Asata* and *Sata*, are discretized into their fundamental particles called *parmaanu* (for more details see 'Vedic Triune Atom' in Chapter 5).

**Deductions from the mantra**

**(RigVeda, 10/129/1)**

- (1) On the eternal time-line, before the onset moment of the present creation of the universe, the entire matter of the universe existed in the non-definable conglomerate of the *Asata*-state and not in the observable or measurable *Sata*-state.

- (2) *Vyom,* the Space-entity spread out in all directions, present everywhere far and wide, serving as the place for the cosmos of the entire creation, existed but not in its present vastness.

- (3) Nature in the *Asata*-state exists in a dense, gravid, fog-like state of matter. The existence of Nature in the *Asata*-state before

time-zero of the present universe necessitated the pre-existence of Space and Time. The existence of a special mathematical condition such as the dimensionless space-time singularity in modern Big Bang cosmology was not necessary wherein the Space and Time are assumed to be born along with the matter of the universe.

- (4) The visual context of the dark-gravid fog (of primordial matter) preventing discernment of '*what covers what'* represents the dense state of matter in the indefinable *Asata*-state.

It is interesting to note that the mantra's description of the primordial universe (Deduction (4)) sounds quite similar to the descriptions found in the articles on modern Big Bang cosmology: '*it existed like a thick soup of quarks*'; '*the universe was a soup of protons, electrons and more exotic atoms*'; '*the fog of the universe cleared*'; '*before decoupling occurs most of the photons in the universe are interacting with electrons and protons in the photon-baryon fluid'; the universe is opaque or "foggy" as a result* and *'there is light but not light we could observe through telescopes'*.

To have a complete thought expressed in two lines of a mantra is unique to Vedic poetry and to have it expressed in a desired poetic meter formed with a specific count of alphabets, forming meaningful Sanskrit terminology in cosmology, is remarkable.

**RigVeda Mantra (10/129/2)**

After the first mantra of the *Bhavavrittam sukta* depicted the state of the Nature-entity in the *pralaya* phase (dissolution) the second mantra continues with the *pralaya* phase stating the pre-existence of the Efficient-Cause (Creator) and the material-cause (Nature). The mantra indicates that when the Nature existed in the undefined passive *Asata*-state, it was not alone. With Nature also existed an entity bigger than and different from Nature. The mantra also indicates what was absent in those early moments of creation:

न मृत्युरासीदमृतं न तर्हि न रात्र्या अन्ह आसीत्प्रकेत: ।
आनीदवातं स्वधया तदेकं तस्माध्दान्यन्न पर: किञ्चनास ॥
( RigVeda, 10/129/2)

**Transliteration:**

**"***Na mrityuraaseedmritam na tarhi na raatrya anha aaseetpraketah.*

*Aaneedvaatam svadhya tadekam tasmaaddhaanyanna parah kinchanaas."*

**Word Translation:**

न (*na*) = neither , मृत्यु: (*mrityu*)= death , आसीत् (*aaseet*) = existed , अमृतम् (*amritam*) = birth of living-beings , न (*na*) = nor , तर्हि (*tarhi*)= at that time , न (*na*) = not , रात्र्या: (*raatryaaha*)= night's , अन्ह: (*anha*) = day's, प्रकेत: (*praketah*) = special indicator, specific sign, defining symbol, आसीत् (*aaseet*) = existed ।

आनीत् (*aaneet*) = existence of conscious being, अवात: (*avaatah*)= stable, unshakable, स्वधया (*svadha-ya*) = with Nature's (Svadha is the term for Nature with property of eternal self-existence, synonym 31 in Table 5.1), तत् (*tat*) = that, एकम् (*ekam*) = The One, unique (for Brahmn the Creator), तस्मात् (*tasmaat*) = from Him, अन्यत ह (*anyat ha*) = none like Him, पर: (*parah*) = supreme, nothing beyond it, nothing more than Him, किञ्चन (*kinchan*) = nothing, न (*na*) = not, आस (*aas*)= exists. ॥

**Mantra Translation:**

*"At that time neither the process of birth and death existed nor existed any specific symbols of creation - the day and night. Present then, with Svadha the eternal Nature is the One and none other like Him, unshakable, immutable Supreme Conscious Being and nothing exists beyond Him."* (RigVeda, 10/129/2)

## Mantra Interpretation

The important terms in this mantra requiring interpretation are: *amritam, mrityu, svadhaya*, *avatah,* and *praketah*. The term *amritam* is primarily for 'eternal existence' and is associated with the conscious-being souls (*amritam*) and not inert substances. As discussed in Chapter 5, the quantized consciousness called the souls is not created afresh with the creation of the universe. They pre-exist, are eternal and active participants in the creation phase when Nature springs into the *Sata*-state of matter. The souls (*amritam*) during the *pralaya* (dissolution) phase, not having *Sata* matter to form the physical body with knowledge senses and karma functions, exist but there is no process of birth and death (*mrityu*). The *pralaya* (dissolution) phase, also addressed as *Brahmn*'s night, is when all activities cease with the souls in a slumberous *sushupti* state. The other two main causes of the universe also exist in the non-active state during the *pralaya* phase of the universe, the efficient-cause and the material-cause respectively the Creator and the *Svadha* (Nature).

*Praketah* or *praketam* in this and the next mantra stand for defining-symbols of the universe. When one digs deeper into the Vedas and the ancient Vedic Literature one finds that the term *praketam* is for non-changing beacons and indicators in the form of objects and phenomena associated with the visible universe during its creation phase. These objects are the directions, the Sun, the Moon, the constellations and the other celestial objects. Also included in the list are phenomena such as the day-night cycle, *Vyom* (Space) and the perpetual motion of the cosmological objects. The mantra reveals that these indicators did not exist in the Nature's dissolution phase. The mantra has utilized the specific synonym of Nature, the *Svadha,* to convey the fact that the universe in the *pralaya* phase is not a 'nothingness'; the Creator exists even then with *Svadha,* the latter being an inert eternal entity. It was stated in Chapter 5 that the literal meaning of *Svadha* is - '*an entity without being the effect of a cause that has eternal existence of its own*'.

The mantra emphasizes that with the *Svadha* existed then the एकम् (*ekam*) - the One, with virtues of being the ultimate, unwavering and unaffected by physical forces and is beyond everything else in the universe. The term तस्मात् (*tasmaat*) stands for the conscious-being *Brahmn* the

Creator. If one were to express the second part of the mantra in physics terminology using '*Brahmn*' for the *ekam*, one would put it thus,

> "*… In addition to Nature (Svadha) there existed an all-pervading energy field unaffected by physical forces and processes. Entire matter of the universe was embedded in Brahmn and Brahmn extended beyond the universe and nothing extended beyond Brahmn*". (RigVeda, 10/129/2)

Thus in the Vedic Creation Principle the unitary conscious-being, the Creator and inert Nature, the matter of the universe, are two distinctly different entities, unlike in some philosophies where they are one and the same thing: either it is all matter or it is all consciousness.

The word *vaatah* means 'with motion' or 'with vibrations or 'a wavering action'. The negation of it with the prefix '*a'*, gives the adjective of *avaatah,* meaning the entity without physical vibrations in it or without any physical motion in it. Therefore, because Nature exists within the Creator, all physical phenomena exist within the Creator yet they are not a part of the Creator's character. The *yaugik* meaning of *avaatah* in the mantra when associated with God means that the changes in Nature do not alter or affect this unique all-pervasive 'energy field' extending beyond the universe. In addition to the adjective of *avaatah* in this RigVeda mantra the reader may recall other virtues of this efficient-cause of the universe listed in the YajurVeda mantra (YajurVeda 40/8) cited in Chapter 5 while defining the Creator entity. The Creator-entity of the Vedas is like a uniform field of energy or like an all-pervading force.

**Deductions from the mantra**:

- (5) Before the beginning of a practical universe, two eternal entities, the efficient-cause (Creator) and the material-cause (Nature = matter) existed, the Nature embedded within the Creator, with the souls in *sushupti* (sleepy state).

- (6) The efficient-cause of the universe as defined by the Vedas is an all-pervading, unchanging and unwavering Energy Field with the attribute of consciousness and which is infinite in strength and extent, encompassing all forms of matter and energy of the universe. This author has addressed the Creator as the **'Creation Energy Field'** or the **'Creation Force'**.

The first two mantras from the *Bhavavrittam sukta* of RigVeda presented above provide a glimpse into the picture of the universe before the creation began. The obvious precondition in the process of creation was the pre-existence of the two eternal causes (Creator and Nature) and the third general-cause – all quantized eternal souls as the passive participant. The RigVeda in the third mantra presents the fundamental condition of matter itself in the pre-universe Nature.

**RigVeda Mantra (10/129/3)**

तम आसीत्तमसा गूढमग्रेऽप्रकेतं सलिलमं सर्वमा इदम् ।
तुच्छ्येनाभ्वपिहितं यदासीत्तपसस्तन्महिना जायतैकम् ॥

( RigVeda, 10/129/3)

**Transliteration:**

**"***Tam aaseettamasaa goodhamagre-a-praketam salilam sarvma idam, tuchchhayen-aabhvapihitam yadaaseett pasastanmahina jaayataikam*"

**Word Translation:**

तम: (*tamah*) = the Nature in the state of darkness (devoid of radiation), आसीत् (*aaseet*)= existed , तम: स (*tamah sa*) = that cause with darkness, गूढम् (*goodham*) = covered with , अग्रे (*agre*) = prior to creation, अप्रकेतम् (*a-praketam*)= without indicators of the creation, सलिलम् (***Salilam*)** = the form of Nature with all three of its fundamental forms of matter uniformly dissolved in it (in causal state) , सर्वम् (*sarvam*) = all , इदम् (*idam*)= this ।

तुच्छ्येन (***tuchchhayen***)= diminutive, beginning from small, confinement in small form, आभु (***aabhu***) = (three meanings) Nature out of its causal form or to come into being with certainty or the 'effect', as in cause-effect, अपिहितम् (*apihitam*) = hiding all or covering all, यत् (*yat*)= that , आसीत् (*aaseet*) = exists, **तपस: (*tapasah*)** = heat energy (power) , तत् (*tat*) = to it, महिना *mahina*) = great influence, omnipotence, अजायत (*ajaayat*) = comes into existence, or comes into active form , आ: (*aah*) = was, एकम् (*ekam*) = The only one, Brahmn (the Creator) ॥

**Mantra Translation:**

*"इदम् सर्वम् (idam sarvam), this entire observable universe; अग्रे (agre) preceding its existence; was in its causal form (the **Salilam**) without any defining symbols of creation. Even that 'material cause' was covered with the darkness. Aabhu, the Nature (universe) in its state of existence was hidden in **tuchchhaya** (small, diminutive) causal state of matter. Due to Brahmn's great influence of heat energy* **(तपस: = *tapas*)**, *the Nature from its causal state comes into active state of matter.* (RigVeda, 10/129/3).

**Mantra Interpretation**

The continuing theme in the last three mantras is the darkness in the pre-universe matter, suggesting a total absence of radiation. These mantras also unambiguously state that none of the diversity of the effulgent and active universe exists in that slumberous state of matter. For all practical purposes, such a condition of matter is the non-definable dark matter named by the Veda as the *Asata*.

The general term for the *Asata* and *Sata* states of Nature is *Prakriti* as indicated in the first mantra. In the second mantra the Nature is addressed as *Svadha* and in the third mantra it is addressed as *Salilam*. While the term *svadha* (see synonym 31 in Table 5.1) expressed the status of Nature, the term *salilam* (synonym 28 in Table 5.1) expressed Nature's physical

condition. The *yaugik* meaning of *Salilam* for the Nature-entity yields that it is in a completely uniform state with even the most fundamental form of matter in the tri-state of *sata, raja,* and *tama*, indistinguishably mixed.

The grammatical analysis of the term *salilam* gives further insight into why this particular term is used for Nature. *Salilam* originates from the root that represents motion. It is formed from *'sal' dhaatu* (root) and '*ilach' pratyaya,* which yields **-** '*to impel into its causal form'* or '*to go into its dissolved state*'. The ordinary (*rudhi)* meaning of the term generally found in literature is - 'water' or '*one that flows*'. These *rudhi* meanings are however far removed from the Vedic *yaugik* meaning of *salilam* where it is Nature in its causal state from which it reverses to come into existence. Nature is addressed further with other most used synonyms such as *Prakriti*, *Aditi*, *Prajapati* and so on.

Because it conveys the property of fluidity, the term '*salilam*' is a *rudhi* synonym for water. Water is also *salilam* because, specific visible substances like sugar, salt and other minerals dissolve in it and disappear in it losing their identity. In the example of water and sugar, the solvent and solute are two different substances, however, in the case of the mantra's *salilam*, the entire Nature-entity, which itself is the matter of the universe, is both - the solvent and the solute. In the *pralaya* phase the Nature dissolves into itself losing its diversity of the *srishti* phase. The *salilam* state of Nature is its *Asata*-state. Nature is in the *Salilam* state when all categories and forms of matter in it are dissolved to form its fundamental state with the ultimate form of inactive fundamental particles *sata, raja,* and *tama* existing in it. At that stage there are no atoms like Hydrogen (H) and Oxygen (O) to form water molecules ($H_2O$). In that phase of matter, before the creation began, there was no existence of water either. Therefore the *yaugik* (Vedic) meaning of *Salilam* in the mantra is the *Prakriti* in its pre-creation and pre-active causal state.

This balanced causal state of matter is perturbed by the external force of the Creator Energy Field which according to the mantra creates the physical form of energy - the heat. This external heat energy sends the Nature from its inactive *Asata*-state of matter to its active *Sata*-state.

In the framework of philology and philosophy, prevailing in Rishi Yask's ancient Nirukt Sutra, the interpretation of the first word of the second line of the above mantra has drawn his attention as well. This important word is ***tuchchhaya*** (pronounced with a soft t), a diminutive

volume of the Space-entity holding the entire causal matter of the universe before the Vedic Big Bang takes place. From Acharya Udayaveer Shastri's elaboration in his "Saankhya Siddhant" (1991) commentary, this author gathers that the discussion on this Sanskrit term by the ancient a*charyas* and Vedic philosophers is copious. The discussion in the ancient Vedic Literature on ***tuchchhaya*** is probably much more than the discussion in modern physics and cosmology on the equivalent mathematical condition the "space-time singularity" that gives rise to the modern Big Bang. The similarity between the two discussions is that both are in the context of cosmology and the creation of the universe and the difference is that the discussion in Vedic Literature on ***tuchchhaya*** is spread over a time span of millennia in the books written by the *rishis* and *acharyas* in different time epochs; the discussion on the Big Bang singularity is only about a century old. In modern times, Acharya Udayveer Shastri has presented a lengthy discussion of his own on all those ancient interpretations and discussions on this RigVedic term. Of these interpretations the most accepted meaning of ***tuchchhayen*** is based on the interpretation of Yask Rishi's Nirukt Sutra elaborated in Durg Vritty (7/3) written by the ancient Acharya Durg. Durg stated that it is: *tuchchhayen, svalpen, sookshmen* which respectively are - *diminutive*, *shrunken* and *minute*. So the तुच्छयेन आभु (*tuchchhayen Aabhu*) of the mantra is - '***the diminutive Nature confined in small space***'. The Nature (matter) in a Vedic defined *pralaya* (dissolution state) is inactive and therefore devoid of any dynamic activity, even in the structure of fundamental particles, leading the Nature to be confined in a relatively smaller space than in its *srishti* (creation phase). In addition to the Nature in its causal *Asata*-state addressed as *Salilam*, the Nature in its 'state of being' in the *Sata*-state, called *Aabhu*, also implies that the creation begins with Nature confined in diminutive Space called ***tuchchhaya***. The term ***tuchchhaya*** by no means implies that the Nature ever goes into a state of 'nothingness'.

Let us look at the term ***tuchchhaya*** from the perspective of modern cosmology. Cosmologists stipulate that the present observable universe is spread across the unimaginably large space with a radius of about $4.4 \times 10^{23}$ km with extremely low matter density of $3 \times 10^{-31}$ gm/cc (grams per centimeter cube) compared to the water density of 1 gm/cc. We have also learned that the universe is 74% Hydrogen, the smallest atom and about 25% of the universe is in the next smallest atom, Helium and the rest, the

1% is in other heavier atoms. If we imagine all mass of the universe together in one place as a single ball of matter, the entire universe becomes imaginable and comparable to the objects in the vicinity of the Earth, the solar system for example. Let us assume for a moment that all mass of the universe is Hydrogen and shrinks into a single compact mass with the same density as liquid water (1 gm/cc), one gets a ball of liquid with the radius of only about $3x10^{13}$km. This 15 billionth shrinkage in the universe could be addressed as ***tuchchhaya*** compared to the present observable universe. If we were to imagine how drastic this shrinkage is, think of the present volume of the Earth with a radius of 6,371 km going down to 0.4 mm in diameter, the size of a mustard seed.

A scenario for the *tuchchhaya* condition of the *Salilam* state of Nature is developed in Chapter 7 under the sub-heading of "*Tuchchhayen* versus Colossal" where hypothetically the dynamic activity even in the electrons orbiting the nuclear particles that form atoms, stops. A Hydrogen atom is a proton with one electron orbiting around it. Its radius is $5x10^{-11}$ meter (i.e. Bohr radius) because the electron is orbiting around its proton otherwise the size of the proton itself is about $1x10^{-15}$ meter in radius. Therefore, if the dynamic activity in all electrons is stopped to bring a *salilam* inactive condition in the matter of the universe, one can conceive a further reduction by a factor of 50,000 in the radii of proton and Hydrogen. This exercise takes one closer to the even smaller size of the *tuchchhaya* primordial universe in its *Asata*-state.

How dense could the *tuchchhaya* primordial universe be? If we assume that the matter of the entire universe came together with all its protons and neutrons snug with each other, the density of such a conglomerate will be the same as that of a proton itself. The mass of a proton being $1.7x10^{-24}$ grams and its radius being $10^{-13}$ cm the density of a proton is in the order of $10^{15}$ gm/cc, which is about one thousand-trillion times the density of water or about 100 trillion times the density of steel. Whichever way one looks at it, the Vedic universe does not begin with a 'nothingness' like in the Big Bang Hypothesis, because as Kapil Rishi in his Saankhya Sutra (1/43) stated**,***"Nothingness cannot be the cause of something"*.

The adjective *tuchchhayen* in the mantra, for the pre-creation universe, certainly has some commonalities and differences with the Big Bang Hypothesis. The basic commonality is that the universe took birth from the

initial diminutive space. The obvious difference however is in the relative size of this diminutive space. The modern Big Bang Hypothesis advocates that the universe before coming into existence was confined in a dimensionless mathematical space-time singularity with no physical volume whatsoever. The Vedic Big Bang on the other hand began with the Nature confined in a *tuchchhaya* space which relatively has a diminutive physical volume. The Veda also emphasizes that after the Nature came out of the *tuchchhaya* physical real space, it grew to its present enormous size occupying vast space addressed as the *Vyom*. This author has used these Vedic thoughts to develop the Vedic Creation Scenario for the universe.

**The Continuity in the Time-entity**

All three mantras presented above depict the picture of the universe prior to matter transiting from the *Asata* to *Sata* (indefinable to definable matter). The mantra's (RigVeda, 10/129/1) use of the word 'then' for the state of the universe implicitly means the existence of the Time-entity. Therefore, for the Vedas the Time-entity does not start at the onset of the *Sata*-state of matter – it pre-exists the present creation even during the *Asata*-state of matter. From the word-translation of the three mantras one notices that the term आसीत् (*aaseet*) has occurred several times in all these mantras. The meaning of *aaseet* is 'existed' or 'then it was'. The other terms in the mantras such as तदानीम् (*tadaaneem*) meaning '*before the sarg*' or '*before this functioning universe*', तर्हि (*tarhi*) meaning '*at that time*', अग्रे (*agre*) meaning '*prior to creation*' and अजायत (*ajaayat*) meaning '*comes into existence*', all point to the fact that the Time-entity existed before the onset of the *Sata*-state of matter leading to the creation. Moreover, these terms indicate that the emphasis in the subject matter of the mantras is on cosmology.

While defining the Time-entity (*Kaal*) it was emphasized in Chapter 5 that owing to it being an eternal entity and as one of the essential participating causes in the creation of the universe, *Kaal* must pre-exist for the *Asata*-state of Nature in its dissolution epoch as well. Pertaining to the importance of *Kaal* (Time-entity) in the creation process, recall the AtharvaVeda mantras on *Kaal* presented in Chapter 5, specifically the mantras (19/53/4, 5), which stated– "...*In this creation none is older than*

*Kaal"* and "*… the biggest of all devas, Kaal, coexists with Brahmn the Creator and continues to move fast'*. In contrast to this in the modern Big Bang Hypothesis the Time and Space are born for the first time and the matter is born out of nothing; that nothing being the space-time singularity. The *Asata*-state of the pre-creation universe also has no existence in the space-time 'singularity' of the modern Big Bang Hypothesis.

**Deduction from the Mantra**

- (7) The Nature's matter before the creation of the universe, was in the ***salilam*** state with all the matter diversity uniformly dissolved into an indefinable matter-conglomerate of the three inactive fundamental particles *sata, raja, tama*, confined in a relatively smaller space devoid of radiation.

- (8) The Space-entity of the Vedic Cosmology Principle is ***tuchchhaya*** (diminutive) during the dissolution phase up to the onset of creation.

- (9) The fundamental particles of Nature in the initial static state are energized at a given point in time by the **'heat energy'** input from the all-pervading Creator Energy Field, inspiring all particles to enter into a dynamic phase.

- (10) The Time-entity pre-exists in the Vedic creation.

The next four mantras deal with the *srishti* (the creation) phase.

**RigVeda Mantra (10/129/4)**

**कामस्तदग्रे समवर्ततताधि मनसो रेतः प्रथमं यदासीत् ।**
**सतो बन्धुमसति निरविन्दन्हृदि प्रतीष्या कवयो मनीषा ॥**

( RigVeda, 10/129/4)

**Transliteration:**

**"***Kaamastadagre samvartataadhi manso retah prathmam yadaaseet |*

*Sato bandhumsati nirvindanhridi prateeshyaa kavayo maneeshaa ||*"

**Word Translation:**

काम: (*kaamh*) = ईक्ष्ण (*eekshana*) = 'power with the combination of visualization, thought and desire by which a conscious being is able to create tangible things' or it is a conscious determination to create or the desire to create something with a pre-meditated plan, or the thought to carry out a planned action; all these meanings apply. तत (*tat*) = that, अग्रे (*agre*) = initial state, earlier, अधि (*adhi*)= within (*within the Creator*), समअवर्तत (*samavartat*) = present above all/absolute, मनस: (*mansah*) = of the mind , रेत: (*retah*) = seed of matter, cause for matter, प्रथमम् (*prathamam*) = first (original), यत् (*yat*) = that , आसीत् (*aaseet*) = is or was ।

सत: (*Satah*)= of the matter in existence, बन्धुम् (*bandhum*) = binding principle, the cause-effect principle, असति (*Asati*) = in the indefinable causal state of matter, निर्विन्दन् (*nirvindan*) = to comprehend, हृदि (*hridi*) = in the mind, प्रतीष्या (*prateeshya*) = cognitive process, कवय: (*kavayah*) = rishis, sages, deep thinkers (cosmologists), मनीषा (*maneesha*) = through intellect ॥

**Mantra Translation:**

*"At the beginning of creation, the kaamh (eekshana) of the Creator puts the absolute first-seed the munn-entity (mind) in the retah* (रेत:) *the causal state of the inert Nature. Rishis in their contemplative intellect comprehend cognitively the binding principle of causal relationship that the cause for the*

*Sata, the definable state of matter, lies in the Asata the indefinable state of matter."* (RigVeda, 10/129/4)

**Mantra Interpretation**

There are several terms and concepts in this mantra that are foundational to the Vedic philosophy, crucial for the development of the Vedic Creation Principle in this chapter and in the development of the Vedic Creation Scenario in Chapters 7 to 10. Therefore these terms and concepts are explained ahead of the discussion on the mantra.

## Creator Energy Field: The Supreme Consciousness

The Veda-defined supreme conscious-being Creator is discussed in detail in Chapter 5 under the sub-heading, "The Creator-Entity (*Purush-tatva*)".

### ***Kaamh* (*Eekshana*)**

The *rudhi* (colloquial) meaning of the first word of the mantra *kaamh* is 'desire''. In the context of the creation of the universe a religious connotation of *kaamh* is – 'God's desire'. The *yaugik* meaning (root meaning) of the term *kaamh* is the same as the meaning of the term *eekshana* defined in Chapter 5 under the sub-heading of "Eekshana Force". This force is owing to the consciousness in a conscious-being and is absent in the inert objects. It is "*…the power of the mind with the combination of three factors; visualization, thought and desire, by which a conscious-being is able to create tangible things"*. The Veda being theistic, the *Kaamh* (*eekshana*) in the above mantra pertains to the Creator-entity's application of *visualization, thought and desire* that creates the universe, a tangible object. The Creator's *visualization, thought and desire* are thought to be perfect to create a perfect universe under the perfect laws of Nature that are

also created by the Creator and imposed on the inert matter of the universe, the laws under God's *satyam* system. The *satyam* laws according to the Veda mantras, known in modern cosmology as the laws of physics or the laws of Nature, are also said to have been created and imposed by the Creator because the physics laws do exist with perfection but are not seen as being created in Nature. Therefore, the Creator's *kaamah* in the philosophical perspective is the 'first cause' within the 'efficient-cause', the Creator Himself.

It is an accepted fact in modern cosmology/physics that the Nature's physical laws are so precise and perfect that a miniscule change in them would not have permitted the formation of our universe. However, the modern physics cannot explain what iteration process in Nature led the Nature to finalize its physical laws to such perfection. One could say that the Sun is perfect and the Earth is also perfect and both, together, sustain life on the Earth. Physicists know that the Sun and the Earth evolved over a period of four and a half billion years to achieve this. Yet no physicist can explain how the physics laws appeared in this creation, all perfect for the very first-time, without evolution and iteration. The theistic Vedas give credit to an all-pervading formless conscious-being with the *eekshana* power, the एकम् (*ekam* = The Unique) of the RigVeda mantra (10/129/2) discussed above. The Veda has put the laws governing the consciousness realm of the creation under '*ritam*' and the laws governing the inert realm of the creation under '*satyam*' and addressed these two sets of perfect laws as the Cerator's *ritam* and *satyam*. The underlying premise of the Veda is that only the Creator can create things and laws with perfection. The moment of the onset of the Creator's *eekshana* is the onset of all the laws in both the realms of the universe – the spiritual and the physical (*ritam* and *satyam*). Once the creation is triggered, there is no switching-off of the laws governing the consciousness realm and the laws of physics and the properties in matter that are initiated by the Creator's *Munn* entity. The humans cognitively contemplate and experimentally discover these laws when they are born in the universe. The contemporary physicists have studied the nature of Nature and discovered the laws that are in the realm of *satyam*.

## The Creator's *Munn* (मन)

The other important term in the RigVeda mantra (10/129/4) is the Creator's *Munn*. The *Munn* is the Mind-entity of the Creator that is all-

pervading the universe to interact with each fundamental particle of inert Nature and each conscious-being. It is an invisible all-pervading force owing to the Creator's ***Kaamh (Eekshana)***. This is the Vedic expression for the Mind-over-matter for the Creator to create and govern.

## The Soul's *Munn* (मन)

The pluralized quanta of consciousness responsible for life in their individual material bodies were defined and discussed in Chapter 5 under the sub-heading of "Soul-entity (*Aatm-tatva*)". Ubiquitously present throughout the universe to populate the cosmos, these quanta of consciousness, different from the unitary supreme Consciousness have limited *eekshana* power.

The invisible and individualized mind-entity in a conscious-being is an endowment to the soul from the Creator's all-pervading energy field of the Mind-entity. The level and ability of the potency of the mind-entity in a soul depends on the level of the spiritual evolution of the soul (not the physical or biological evolution). The *munn* carries out the functions desired by the individual's *eekshana*. Even though the *munn* of a soul is invisible, the actions directed by the *munn*, on the command of the soul's *eekshana*, become observable through the behaviour and actions taken by the substantive living body wherein the *munn* resides. The spiritual eternal-entity the soul and the other functions associated with it such as the *munn* (mind), the intellect and the knowledge-senses, are part of the material body serving as the soul's tools. They are all byproducts of matter at extremely subtle states. Vedic thought propounds that *munn* is a singular quantum with a limited potency in each individual conscious-being. Among the created physical entities of the universe the fastest according to the Vedas is the *munn*; faster than the speed of light. The Veda-defined *munn* in contemporary physics expression is – the entity possessing the property of 'action at a distance'.

In contrast with the Creator's *Munn* covering the entire universe and beyond, an individual conscious-being with a living body not pervading through all matter, follows the instruction of the conscious-being. It would suffice here to say that the *munn* is a distinct functional force in each conscious being that establishes a connection between the consciousness in a living-being and the external world. In contemporary expression this is the connection between the consciousness and matter. Not having a proper

word available in English, the term '*munn*' is translated as the 'mind' in a person.

### ***Retah*** (रेत:)

The *retah* are the pluralized inert fundamental particles of matter. The mantra states that the *retah* particles are the causal state of Nature. This means that a conglomerate of all *retah* together causes Nature. Conversely the Nature that we see in the form of matter and energy as resplendent cosmos is corpuscular at its fundamental level. A Vedic principle also states that an entity formed out of inert components is also an inert entity and has no *eekshana* and inspiration of its own to create something specific. The causal state of Nature is when fundamental *retah* particles are in complete inaction, a condition termed by the Veda as *sushupti* (slumberous state). This condition of matter is the indefinable *Asata*-state discussed under the first mantra (10/129/1) above. To create activity in the inactive matter particles confined in the *Asata*-state of Nature, something has to change this equilibrium. The fourth mantra (10/129/4) states that it is the Creator's ***Kaamh*** that *puts the absolute first-seed, the munn-entity* (*mind*), *in the retah* of Nature when each inactive *retah* is affected by the Creator's *munn* and transits into an active *retah*. With each and every *retah* particle affected by the all-pervading Creator's *munn-entity* the indefinable *Asata*-state of Nature transits into the definable *Sata*-state. This is the meaning of "…*the cause for the Sata the definable state of matter, lies in the Asata the indefinable state of matter"*. The *eekshana* power's operator is the *munn*-entity which establishes the interaction between the consciousness and matter. The Creator's *munn* therefore operates on the *retah* (रेत:), the fundamental seeds of inert Nature and energizes them to take active part in the process of creation.

The action by the Creator's *Munn* is an instantaneous event and therefore the 'switching' of the *retah* from the non-active to the active phase under the influence of the Creator's *Munn* is an instantaneous event. This is the transformative moment when all particles of Nature change from an introvert *sushupti* (slumberous) state of *pralaya* (dissolution) to its extrovert *jaagriti* (awakened) state of *jagata* (creation). It is this change in the nature of particles that allows their presence to be felt by other surrounding particles. Depending on their physical nature, the interaction

with each other under the physical laws of Nature leads to the observable creation.

The Vedic *Munn* entity, imparted to the universe by the Creator, is a force at the metaphysical level, all-pervading through fundamental particles of Nature. Down the timeline of the creation-phase of the universe, when creation acquires sufficient conglomeration of active fundamental particles, the quanta of energy and bigger particles with specific stable structures are formed such as the atoms and molecules of elements. The atoms and molecules lead to the formation of cosmological objects, like the Earth, the Sun, the stars and galaxies of stars. The conscious-being souls are able to acquire physical bodies from the matter particles on the terrestrial bodies like the Earth and inherit their own *munn* from the pre-existing all-pervading *Munn* energy field of the Creator. This is how an individual conscious-being soul establishes its own connection with the physical world that enables the conscious-being to do karma while being in a physical body.

It is the Vedic defined '*munn*' entity, an active function in each conscious-being that enables a connection between the individual conscious-being and matter. The individual *munn* in an individual conscious-being is the link between the outside physical world (matter) and the mind of the individual conscious-being. The Creator on the other hand with His all-pervading *Munn* is connected at the same time and all the time to the entire creation, including each fundamental particle and each individual conscious-being. It is the Omnipresent Creator's *Munn* that makes Him Omnipresent and it is His active *Munn* linked to the entire universe that makes Him Omniscient. Absence of such possibilities in modern cosmology eventuate a struggle to understand the true spirit of the Anthropic Principle in Cosmology.

When a human-being begins to build a house, he (or she) invokes his *eekshana* and *munn* with *visualization, thought* and *desire*. His *eekshana* and *munn* serve as his limited laws of *ritam* to implement the plan of the house and his *visualization, thought* and *desire* serve as his limited *satyam* laws governing all the required physical principles and methodologies needed to effectuate the physical entity – the house. Before he begins to build the house his *eekshana* with the implements of *visualization, thought* and *desire* ensure him that once the work is initiated the house building moves forward on the desired time-line without a collapse in the middle.

When an efficacious plan of a house is implemented there is no switching-off of the plan.

The Creator builds the universe to shelter all cosmos. Once the Creator launches the plan with *Eekshana* and *Munn*, there is no room for switching off the plan, leading to chaos and collapse of the universe. In the logic of the Vedic philosophy the creation job cannot be assigned to an inert foreman, Nature, which is devoid of any initiative of its own to energize and build itself with *visualization, thought* and *desire*. If left to the inert Nature, lacking *eekshana*, Nature's different limbs would work independently and all physical processes in it would remain incoherent random phenomena with chaos as its inherent property. It comes down to the old question – if there is a law of gravity to bring matter together, why is there a law of gravity in the first place? Then, why is the value of the gravitational constant so critically right which ultimately enables the universe to have intelligent beings in it? If it was only Nature, could the inert Nature want to come into form?

The Vedic *rishis* in their contemplative study and analysis of Nature were satisfied with the answer that the Creator's preset *ritam* laws (governing both realms of creation, animate and inanimate) and *satyam* laws (govering the physical realm of the creation), imposed order on the universe and revealed a perfect universe with no room for chaos. It is these preset *ritam* and *satyam* laws that keep Nature connected with the Creator. Imperfect ordinary conscious-beings create imperfect objects. However, a common factor between the imperfect creation by an imperfect conscious-being and the perfect universe created by the Creator is that both creations operate under their creator's pre-imposed rules!

From the perspective of modern physics, all knowledge in the universe relates to matter, its forms and phenomena. All forces and energy fields pervading through the universe are said to be the inherent nature of matter. Modern physics does not have a scope for gathering knowledge from something other than matter, such as the consciousness. Once one embarks upon developing the understanding of the phenomenon of consciousness, as the ancient *rishis* of the Vedas have, one has to widen the scope for gathering knowledge from a realm separate from the realm of matter. In doing so one has to recognize an additional suite of definitions of energies, forces and entities that are different from those in modern physics. The *munn* force, the subject of discussion here, is one such force operating

through each conscious-being. It should suffice here to say that according to the Vedic philosophy, the *munn* force (mind-entity), is unobservable by physical means, is a byproduct of matter, subtler than all energy forms known in physics. Each conscious-being inherits his/her own *munn* from the all-pervading pool of the universal *Munn*-entity. Just as the gravitational force and the other three forces are the inherent property of matter, the *Munn* force is an inherent property of the universe which operates through the conscious-matter.

Stephen Hawking in his book entitled "The Grand Design", co-authored with Leonard Mlodinow, emphasized that the universe comes out of nothing and that the Creator was not necessary. In the Vedic Creation Principle however, the universe comes out of the same Nature initially confined in a diminutive Space (*tuchchhaya*) with Time continuously running and the creation starts with 'something', the pre-existing material in the *Asata*-state. The Vedic physics is inclusive of inert energy fields as well as the energy fields operating through consciousness like the *Munn*-entity.

## The Cause-Effect Principle in the Mantra

The last line of the mantra translation, –"… *Rishis in their contemplative intellect comprehend cognitively the binding principle of causal relationship that the cause for the Sata the definable state of matter, lies in the Asata the indefinable state of matter*" clearly exhibits the presence of the cause-and-effect principle right from the beginning of the universe. It is observed that conscious-beings at all levels of their biological evolution exhibit the inherent desire to acquire knowledge. Without the unchanging cause-and-effect principle in Nature, the individual conscious-beings would not determinedly engage in the pursuit of knowledge. The recognition in the mantra of the importance of the all-pervading principle of cause-and-effect pertaining to one matter state transiting into another is a remarkable physics inference in the mantra. From a philosophical perspective, the cause-effect principle of the mantra teaches a fundamental step in the logic system.

### Deductions from the Mantra

- (11) The universe is an 'effect' of a causal relationship between the 'efficient-cause' (Creator) and the 'material-cause' (Nature).

- (12) In the Vedic Creation Principle, matter and consciousness are two separate entities yet they are an integral part of the created universe. The consciousness-matter interaction is through the metaphysical entity called *munn*.

The fifth mantra of the *Bhavavrittam sukta* illustrates the actual birth of the universe in terms of the expansion of matter and radiation in all directions with the universe's ultimate fate being the reformation into fundamental building blocks called atoms and the mega celestial objects. This may sound similar to the modern Big Bang Hypothesis, but this is exactly what this ancient mantra states. Here it is!

**RigVeda Mantra (10/129/5)**

तिरश्चीनो विततो रश्मिरेषामध: स्विदासीदुपरि स्विदासीत् ।
रेतोधा आसन्महिमान1 आसन्त्स्वधा अवस्तात्प्रयति: परस्तात् ॥
RigVeda, 10/129/5)

**Transliteration:**

"*Tirashcheeno vitato rashmireshaamadhaha svidaaseedupari svidaaseet |*
*Retodha aasanmahimaan aasan natasvadha avastaatprayatih parastaat ||*"

**Word Translation:**

तिरश्चीन: (***tirashcheenh***) = directional / transverse / all-around, वितत**:** (***vitatah***)= instantaneous-expansion, रश्मि(***rashmi***)= rays of matter/light in interlacement, एषाम् (*eshaam*)= of these, अध: स्वित् (*adhah svit*) = and down wards, आसीत् (*aaseet*) = exists, उपरि स्वित् (*upari svit*) = and upwards, आसीत् (*aaseet*) = exists ।

रेतोधा: (***retodha***) = fundamental seeds of matter, आसन् (*aasan*) = to become, महिमान [1] (***mahimaanah***) = great objects of creation, the cosmos, आसन् (*aasan*) = to become, स्वधा (*svadha*) = Nature (as in second mantra), अवस्तात् (*avastaat*) = subordinate/inferior , प्रयति: (*prayatih*) = the Creator's inspiration, परस्तात् (*parastaat*) = paramount/superior ।।

**Mantra Translation:**

> *"At the onset of creation, there is* वितत: (*vitatah*) *the instantaneous-expansion of the rays of* रेतोधा: (*retodha*) *the fundamental seeds of matter, omnidirectional, interlaced transversely all-around, existing above as well as below. These fundamental seeds of matter are the cause for great objects*[1] *of the cosmos. In this process, the Svadha (Nature) is subordinate and the Creator's inspiration is paramount."* (RigVeda, 10/129/5).

**Mantra Interpretation**

This mantra delineates the process of the creation of the universe where the rays of matter forcefully burst out in all directions in a sudden expansion. Implicit in the omni-directionality of the rays of matter under the conditions of instantaneous-expansion (वितत: - ***vitatah***) is that the sudden expansion started from a centre outward. The word ***rashmi*** stands for rays as well as for interlacement as in a spread out netting where all parts of the netting are connected with all other parts. This means that matter is not just thrown out to the periphery as in an ordinary explosion; rather the hurled out matter interlaced by the gravitation field filled the intervening space. The word ***rashmi*** is also an adjective for directionality and dynamics. So is the meaning of the word ***tirashchinh***. It is associated with the objects in motion, directed from one point to the next. In physics terminology this action is therefore 'vectorially pointing outward'.

The mantra very clearly states that in the early universe the rays of matter (रेतोधा: = *retodha*) shoot out in all directions, suggesting the start of the explosion with a smaller volume and going on to a larger volume in time. There are all indications in the mantra that the process of this explosion created a network of matter as it expanded in all directions. So that a reader does not imagine this net of matter to be like an ordinary net of two dimensions, the mantra, by virtue of the terms अध: स्वित् (*adhah svit*) and उपरि स्वित् (*upari svit*), makes it explicit that this network of matter is three-dimensional. The terms अध: स्वित् (*adhah svit*) and उपरि स्वित् (*upari svit*) respectively stand for downwards and upwards.

To express the interlacement of the three-dimensional network of matter of the universe, the modern cosmology uses expressions such as - 'the *galaxies in the universe are distributed in a great cosmic web of filaments*". This is not too far from the process delineated by the mantra. The Vedic term of great significance in the mantra is ***vitatah*** for ***sudden expansion*** of the matter of the universe. This together with the inter-connectivity and directionality of the *rashmis* yields a temporal physical phenomenon representing 'instantaneous expansion' or 'sudden spread'. Therefore, the advent of the universe according to this mantra was an explosion throwing matter in omni-directional rays exploding in all directions, up, down and sideways from the centre. This is the **Vedic Big Bang.** This is the *raison d'etre*, for the title of this book.

One wonders how in the world, millennia ago, the Veda boldly put forward the central doctrine of the beginning of the universe from ***tuchchhayen*** *Svadha*, the Nature in diminutive space (RigVeda mantra,10/129/3) to ***vitatah*** instantaneous expansion of matter (RigVeda mantra, 10/129/5) emanating as ***rashmis*****,** the rays of matter, interlaced omni-directionally in a network of matter. Without the discovery of the Doppler Effect in the spectrum of distant galaxies showing a shift towards the red wavelengths owing to their motion away from the observer, the modern cosmology would have hypothesized that the galaxies were stationary and the universe was in a steady state. The observed red-shift in the spectrum of distant galaxies in all directions of the universe suggested that the universe was expanding in all directions. The obvious conclusion from this expansion was that the universe is not in a steady-state and tracing this expansion back in time should yield its beginning. This is the theme of

the modern Big Bang Hypothesis. In the modern Big Bang Hypothesis the universe begins with a big bang explosion in the matter of the universe confined in a dimensionless space-time singularity. Compared with the modern Big Bang Hypothesis and its dimensionless singularity as the 'seed' of the universe, first proposed less than a century ago by Georges-Henri Lemaitre in 1927 CE, there is the millennia old Vedic doctrine under which the birth of the universe also began with a Big Bang in the *Svadha* (the matter of the universe) confined in a ***tuchchhayen*** diminutive space.

When one comes across the concurrence of thoughts from authors millennia apart, as in the case of Lemaitre on the modern Big Bang Hypothesis in 1927 and Rishi Prajapati Parameshthi's *Bhavavrittam sukta* ("***History of Creation of the Universe"***) of RigVeda eons ago, one is astonished with a physics outcome of the mantra and fascinated to understand its reality. In modern society it is sometimes theorized that the past societies were only a precursor to the development of the present society. The idea behind the modern Big Bang Hypothesis is basically the same as in the Vedic Big Bang – the universe created out of an explosion in space. It is logical to surmise that the modern cosmologist reached his/her deduction after developing rich and comprehensive knowledge in astronomy / cosmology / physics. It is also logical to surmise that a Vedic *rishi*, based on his deep and comprehensive knowledge in astronomy/cosmology/physics drew the same deduction as a modern cosmologist, that the birth of the universe began with a Big Bang in the *Svadha* (the matter of the universe) with a *vitatah* (sudden expansion) in all directions creating an interlaced network of matter-objects formed out of the exploded matter. It would be illogical to say that a Vedic *rishi* drew this deep scientific deduction by sheer chance and it would be ridiculous to say that the Vedic *rishi* of ancient India copied this scientific thought from the modern Big Bang Hypothesis. On the contrary, since the RigVeda translations have been available to early Indologists/Sanskritists exterior to India, for the past several centuries, it is possible that the RigVeda's 129$^{th}$ *sukta* of its chapter 10 has been the source for the contemporary Big Bang Hypothesis.

The Vedic Big Bang is not formulated by a fleeting mantra. Rishi Prajapati Parameshthi developed it through the full *sukta* (section) named *Bhavavrittam* with seven mantras in it. His formulation on the creation of the universe is not a mere academic account; it deals with the processes and

principles and the state of matter from the indefinable *Asata* to the definable *Sata*-state.

In the modern Big Bang Hypothesis the creation of the antimatter, at the same time, in the amount equal to the created real matter to form the universe is a pre-condition of the process; however, there is no clear accountability as to what happened to the created antimatter. In the Vedic Big Bang of the *Bhavavrittam sukta* also there exists indefinable matter termed *Asata*, a state of matter from which a universe could not be created, however, it is accounted for completely because the entire matter of *Asata*-state itself transits in its entirety into the *Sata*-state, latter being the suitable for creating the universe. Therefore, unlike the modern hypothesis, the Vedic process is logical with the principle of "conservation of matter" intact. It is the volume and not the mass that changed in the Vedic process because the primordial matter concentrated in ***tuchchhaya*** diminutive space exploded with the rays of matter rushing in space omni-directionally leading to the expansion of the universe. Even if Rishi Prajapati Parameshthi of the *sukta* had looked up at the night sky, he would have observed the universe night after night in a steady state. Even if he observed the night sky throughout his life-span, he would have found that the distance between stars and galaxies did not change and therefore he could have concluded that the universe was in a steady state, just as the modern cosmologists found it before observing the red-shift in the spectrum of distant galaxies. Contrary to postulating that the universe was in a steady state, Rishi Prajapati Parameshthi stated in the fifth mantra (RigVeda, 10/129/5) that the universe originated in an explosion and is expanding unimpeded in all directions. The author is fascinated with the degree of modernity in the science thought of a Vedic *maatali* (cosmologist) of far antiquity implementing the adjective of वितत: (*vitatah*) for the impetuous explosion in the enormous primordial ovate, the Golden- embryo (*Hiranya-garbh*).

Aleksander Friedman in 1922 published his theory of the expanding universe. Five years later in 1927, Georges-Henri Lemaitre put forward the modern Big Bang Hypothesis and two years after that in 1929 Edwin Hubble observed outward motion of distant galaxies detected through the Doppler-shift in their spectrum towards the red wavelengths. Yet mysteriously to the amazement of all, Rishi Prajapati Parameshthi eons ago laid down a doctrine on the creation of the universe where the matter of the

universe started from the pre-existing diminutive Nature. The mantra (RigVeda, 10/129/5) does not stop at just the Vedic Big Bang picture of the universe; it has several other mysteries to unravel.

In the same mantra, after the depiction of 'instantaneous expansion' of the primordial Nature, there is an insightful statement on the 'cause for forming of *mahimaanah*[1]', the great celestial objects (superscripted term in the mantra). The mantra states that the रेतोधा: (*retodha*), the fundamental seeds of matter, meaning the fundamental particles of matter, are the cause for the great objects of Nature. There are two observations in this statement. First relates to the size of the celestial objects and the second relates to the cause of their formation. When one looks up at the sky, during the day or at night, one observes different celestial objects such as the Sun, the Moon, the planets and the stars. Their apparent size does not look large compared to the common objects on the Earth such as the mountains, tall monuments and the trees. Some planets may look bigger than the stars and all planets look much smaller than the Sun and the Moon. Even the Sun and the Moon can easily be hidden behind the small objects of the Earth. But, referring to the celestial objects in the sky, Rishi Prajapati Parameshthi used the term "*mahimaanah*", the pluralized adjective for 'great objects'. How did he know that the apparently tiny looking objects of the sky (stars) are of great sizes? And, how and why would he put forward a principle of the formation of celestial bodies, the great *mahimaanah*, being the aggregates of the minute particles of matter?

As discussed in Chapter 5 the other terms in Vedic physics for the fundamental particles are *aapah* in general and *parmaanus* in particular. Even if one ignored the well-placed Vedic etymology and the *yaugik* meaning of Vedic terminology used here while translating the mantra and instead translated the term रेतोधा: (*retodha*) to mean 'grain of sand', as in common *rudhi* language, the mind-boggling outcome of the statement is that a Vedic *rishi* would propose a mechanism for the formation of the great planets, the stars and the great galaxies, from small individual grains of matter. We have learnt through observations and theoretical advancement in modern astronomy and cosmology that the objects of the cosmos are indeed *mahimaanah* the great objects and are the aggregates of small particles beginning with tiny Hydrogen atoms. This mantra formulates with certainty

the Vedic beginning of the universe and leaves us at a point where the universe begins to take functional shape.

Absent from this Veda mantra is the time-scale of this *Bhavavrittam* the "***History of Creation of the Universe"***. This is unlike the modern Big Bang Hypothesis wherein unimaginably infinitesimal time fractions of the order of $10^{-43}$ second (1 divided by a number with 43 zeros after one) are assigned initially to the early history of the universe. The Vedic time-history for the initiation of the universe is confined within the *vitatah* (instantaneous) expansion, pointing out that it is an extremely fast process. On the other hand there is no guarantee that the universe's timeline prescribed by the Big Bang Hypothesis and the hypothesis itself are valid. Some Big Bang cosmologists have started to cast doubts including a Big Bang theorist Paul J. Steinhardt, the Director of Princeton Center for Theoretical Science at Princeton University in USA (Scientific American, April, 2011).

From a philosophical perspective, the mantras in the *Bhavavrittam sukta* differentiate between the inert Nature-entity and the Consciousness-energy - the Creator. Atheism having no place for a Creator does not have an 'efficient cause'. All 'effects' in Nature are assumed to be the result of a 'material-cause', which is also created out of nothing – the dimensionless 'space-time singularity'. The Nature-entity in the modern Big Bang Hypothesis creates its own existence. Contrasting with this, the Vedas propound that the Creator's *Eekshana* energy is the extrinsic triggering point to the inert Nature.

**Deductions from the Mantra**

- (13) The origin of the Vedic universe is in the instantaneous expansion of matter under the Creator's inspiration, the physical form of which according to the RigVeda mantra (1/129/3) is **तपसः** (*tapasah*), the heat energy.

- (14) The universe is a network of matter with all matter inter-connected.

- (15) The great aggregates of celestial bodies have their beginning from single fundamental particles.

The next mantra goes further from what has been established thus far. It introduces new entities that are created in the sequence of creation.

**RigVeda Mantra (10/129/6)**

को अध्दा वेद क इह प्रवोचत्कुत आजाता कुत इयं विसृष्टि: ।
अर्वाग्देवा अस्य विसर्जनेनाथा को वेद यत आबभूव ॥

( RigVeda, 10/129/6)

**Transliteration:**

**"***Ko addha ved ka iha pravochat kut aajaataa kut iyam visrishtih.*

*Arvaagdeva asya visarjanenaathaa ko ved yat aababhuva*."

**Word Translation:**

को (*ko*) = who, अध्दा (*addha*)= this (with certainty), वेद (*ved*) = having real knowledge of it, क: (*kah*) = who , इह (*iha*) = on this subject, प्रवोचत् (*pravochat*) = to proclaim, कुत: कुत: (*kutah kutah*) = whithersoever, whither from, आ जाता (*aa jaata*) = comes into existence , इयं (*iyam*) = this, विसृष्टि: (***vi-srishti***) = diverse creation ।

अस्य (*asya*) = of this *sarg*, विसर्जनेन (*visarjanen*) = are particularly born, अर्वाक् (*arvaak*) = later on, देवा: (*devah*) = in physical sense: *devah* are Nature's fundamental first-born properties of matter that sustain the creation, in spiritual sense: *devah* are the super human intellectuals, अथ (*atha*) = therefore this , क: (*kah*) = who, वेद (*ved*)= knows, यत: (*yatah*) = therefrom , आ बभूव (*aa babhuva*) = is born/ it comes into existence ॥

**Mantra Translation:**

"*Who has the real knowledge with certainty of whithersoever from this diverse creation (srishti) comes into existence and who can proclaim on this subject? Who can know with certainty that thither from it comes into existence when the devas are born only later in this srishti* (creation)*?*" (RigVeda, 10/129/6).

**Mantra Interpretation**

Implicit in the term *srishti* for the universe, defined in Chapter 5, is that it is not an ever-existing phenomenon and that it 'is a created' phenomenon. The use of the term *srishti* in this mantra and in the next tells us that we are dealing with the universe which is a created phenomenon. The prefix of *vi* in the term *vi-srishti* (विसृष्टिः) in this mantra represents the term '*vividha*', which means '*diverse*' or '*with enormous variety in it*'. Obviously the term *vi-srishti* (विसृष्टिः) for the universe is to encompass the enormous diversity of creation's multifarious nature ranging from the atoms of substances at minute levels to the brilliant galaxies at large scales.

The mantra first raises the perennial question of the enquiring human mind- '*where did all this come from?*' and then hints that an exact answer to such a question may not be extractable from within the properties and systems of the functioning Nature because humans appear later in the creation. The normal practice to gain knowledge about an already existing substance is to study the physical and chemical properties of the substance itself. At the end, such a study may lead to some knowledge of the substance but will not lead to a 'complete knowledge' of that substance because that substance did not come into existence in the presence of the person studying it. Then applying the knowledge gained by the study of one substance to understand another substance would not lead to acquiring exact knowledge of the latter substance either. The mantra's contention is that the 'reductionism' based on the knowledge of the created universe, gained today on the present timeline, is not applicable to the creation process of the universe which took place long ago near time-zero of the present universe.

The premise of the mantra is not to discourage one from gaining knowledge of the process of creation of the universe but it is to point out a logical limit on generating 'complete knowledge' of the first moments of the creation by the conscious-being *devas* (scholarly *rishis*) born much later in the creation, who are extracting the knowledge of creation from the byproducts of Nature. The knowledge of the universe is extracted from the byproducts of Nature that include the invariant functions of Nature, also termed as the inert *devas* that exhibit Nature's fundamental nature. Even these invariant features of Nature are born later on the timeline of creation, limiting the possibility of 'complete knowledge'. The difficult to understand Vedic concept of *deva* is briefly explained below.

# The Vedic concept of Devas - the Energy Fields

The term देवा: (*devah*) is also expressed as *deva* or *devata*. The देवा: (*devah*) concept of the Vedas is unique, extremely complex and has been misunderstood and misinterpreted in ritualistic Hinduism and by many Indologists and Sanskritists of the West. According to what this author has understood from his study of the Vedas, the *devas* taking part in the creation of the universe are not the "gods and goddesses" of the Hindu mythology, they are inert Nature's inert functions carrying out their individual role in the creation and sustenance of the universe. In the consciousness realm of the creation they also work through living matter. They form a physics subject of another book. With the best understanding gained from the book of Nirukt (etymology of the Vedic terms), the Sutras, the interpretations of Veda mantras by Swami Dayanand Sarasvati and other scholarly Vedic writers, the author in this book has attempted to give a physics perspective of the *deva* concept.

The term *deva* has multiple meanings. It is an attribute of both realms of creation – the physical (inert matter) and the spiritual (consciousness). However, from the physics perspective in this book the emphasis is on the *devas*, which are the byproducts of Nature. The knowledge of creation is hidden in the inert *devas* and extracted by the conscious-being *devas* born later in the creation. The inert *devas* being the 'first-born' specific fundamental properties of matter that include invariant forms of matter and energy with the characteristic nature of ubiquity, the Vedas designate them as the *devas*. They are put in the category of the *devas* because they become a permanent feature of the creation and they serve as the essential systems of Nature to help sustain the creation. Being in the *Sata*-state of matter these *devas* are the subject and the source of knowledge about the creation which are dissolved when the nature recedes again into its indefinable *Asata*-state during its dissolution phase. The *devas* are not as eternal as matter (Nature), Time and Space because eternity of the *devas* lasts only for the duration of the creation epoch of the universe.

While the physical universe is an inert phenomenon, the knowledge gathering process within it relates to consciousness, exhibited through living creation. Therefore, to sustain the physical and conscious creations of

the universe, there must be systems that work selflessly perennially, during the life of the creation. In the Vedic terminology these systems are known as the *devas*.

In the physical realm the 'first-born' Vedic *devas* are the specific inert fundamental forms of matter and energy that appear as the properties of matter, create tendencies in matter to start coming together to initiate the creation and are essential for subsequent sub-systems of the functioning Nature. The inert *devas* function nonstop, cooperatively and selflessly to sustain all aspects of the universe. The selflessness in an inert *deva* means that the existence of a *deva* system in the creation is not for itself but it is for the benefit of the others. The terms 'selflessness' and 'for the benefit of the others' are usually associated with living-beings. A mother's love and nourishment of a child are accepted as the act of 'selflessness' and 'for the benefit of the others (child)', therefore it is *devic*. An inert entity's 'selflessness' and 'for the benefit of the others' is taken for granted. In Vedic philosophy however a selfless act even by an inert entity is regarded as *devic*. The Earth, although an inert entity, is in the category of secondary *deva* and termed as a 'mother' who does not expect anything in return for providing the necessary condition and nourishment for the living-beings to survive, to do their karma and to function. The Sun, another inert entity is given the status of a '*deva*' for being a '*shat-krito*'. The '*shat-krito*' is the "one who performs hundreds of acts" selflessly for the benefit of others (living-beings). Its gravitation sustains the solar system, including the Earth. It showers its brilliant illumination non-stop, selflessly on others. In the Vedas, the gathering of knowledge and its dissemination selflessly, is considered to be a noble act. In the spiritual realm the Veda bestows the '*deva*' adjective on virtuous sages, *rishis* and scholars of brilliant intellect and noble character whose selfless existence is for others. In the social context of the Vedic religion and culture, a mother, a father and a guru (teacher) are also considered to be *devas*. The *devas* are created for the benefit of others.

An inert *deva* by nature helps to create the conditions in the universe, cooperatively with the other inert *devas*, for the sustenance of the universe. Here, 'cooperatively' does not mean that the inert *devas* consciously communicate and help each other, it only means that under the physical laws they interact with each other to create the physical systems necessary for sustaining the universe. For example, matter is *Aapah-devata* and

electricity is *Indra-devata*. Their representatives respectively are proton and electron. Under the physical laws of Nature the proton and electron 'cooperatively' join together to give birth to a Hydrogen atom. The emphasis in this book being on the first-created inert *devas*, they are named and discussed further in Chapter 8 with reference to the '*deva sukta*' (*deva* hymn) of the RigVeda (10/72/1-9). This *sukta* also helps to establish the steps in the Vedic creation scenario developed in Chapters 7 to 10. The *devas* are termed as 'first-born' seven 'progeny' of *Aditi* (Nature). The adjective of 'first-born', given by the RigVeda for the inert *devas,* is in reference to the seven primary inert *devas* that are the first creation of Aditi (Nature). Their ubiquitous nature is not only essential for establishing the physical universe; they also help establish the living creation as they function through each living unit as well.

An in depth study of the Vedic *devas* is beyond the scope of this book; a few comments on one of the seven primary *devas*, the *Indra-devata*, is presented here. The *Indra-devata* is an all-pervading property of electricity in matter in the same way as mass is the property of matter (*aapah*). When viewed from a physics perspective an electron is *Indra-devata*'s representative. The electrons (electricity) pervade through matter. Matter cannot come into existence without the *Indra-devata* and therefore the universe cannot come into existence without the *Indra-devata*. The smallest atom of matter (Hydrogen) is formed because there is one electron orbiting in it around its nucleus. This in Vedic expression is stated as – *the Indra-devata helps create the universe*. In how many ways the *Indra-devata* cooperatively functions in the universe, from forming the enormous cosmos to forming a living body of a conscious-being, is in the purview of the Vedic science of *devas* to be taken up in another book.

The non-ubiquitous *devas* such as the Earth and the Sun are grouped into secondary *devas* because although the local region of the universe benefits from them the rest of the universe can do without them. The total number of *devas* in the physical realm, primary and secondary including the forces and energy fields, inherent properties of matter and the periodic systems in Nature, are counted by the Vedas to be 101.

Coming back to the rhetoric question in the mantra (RigVeda 10/129/6) - "*Who has the real knowledge* (of the creation) *with certainty when the devas are born only later in this srishti* (creation)", applies to the *devas* in both realms - the virtuous sages and *rishis* in the spiritual realm

who extract knowledge on cosmology from the Vedas, develop it further and disseminate it to others selflessly and also the *devas* in the physical realm that are Nature's invariant physical functions that remain the source of cosmological knowledge. In understanding a complex phenomenon such as the creation of the universe the limitations in human intellect make it logically impossible to acquire complete '*real knowledge with certainty*'. The knowledge that we gather now about the process of creation is through conjectures, hypotheses and seemingly from logical deductions. The support for cosmology hypotheses from the observational astronomy is also secondary and limited because we are yet to see the exact edge of the universe beyond the so-called "observable universe". Our knowledge of the creation process of the universe will remain only secondary and incomplete because we are born later in the creation. As an example the knowledge about a man gathered by his son is more accurate than the knowledge gathered by his grand-son. A solar physicist/astronomer is extremely knowledgeable about how the Sun and the solar system were formed yet his knowledge is not first-hand. From the knowledge of how the solar system was formed, one could by 'reductionism' claim how the universe could have been formed. But that would only be a conjecture because all of the 400 billion stars of our Milky Way Galaxy were not formed exactly like our Sun. Therefore it comes down to the mantra's exclamation - '*who can proclaim on this subject …with certainty?'*.

At the instant of creation nothing that generates knowledge existed to tell us how it all came to be. Our knowledge of the universe's beginning is based on the extrapolation backwards into its past which is based on the universe's present behaviour. It would be difficult to know if the universe was chaotic in some time epochs, however, the assumption of the universe being non-chaotic through its life enables us to glean cosmological knowledge of it. It is the *deva*-systems according to the Vedas that counter chaos in the universe and establish order in the creation. The mantra's second line states that no one born on Earth can have exact and true knowledge of the creation.

The last mantra of this creation *sukta* deals with the questions raised in the above mantra.

**RigVeda Mantra (10/129/7)**

इयं विसृष्टिर्यत आबभूव यदि वा दधे यदि वा न ।
यो अस्याध्यक्ष:[1] परमे व्योमन्त्सो[2, 3] अङ्ग वेद यदि वा न वेद ॥

( RigVeda, 10/129/7)

**Transliteration:**

**"***Iyam visrishtiryat aababhoova yadi vaa dadhe yadi vaa na.*
*Yo asyaadhyakshah[1] parame Vyomantso[2,3] ang ved yadi vaa na ved*."

**Word translation:**

इयम् (*iyam*) = this, विसृष्टि: (*vi-srishti*) = diverse/multifarious creation, यत: (*yatah*) = wherefrom, आबभूव (*aababhoova*) = is born / originates, यदि वा दधे (*yadi vaa dadhe*) = when it comes into existence, यदि वा न (*yadi vaa na*) = or when it does not exist ।

य: (*yah*) = the/that , अस्य (*asya*) = of all this, अध्यक्ष:**[1]** (*adhyakshah*) = overseer of all / one who exercises supervision / controller, परमे व्योमन्**[2]** (*parme vyoman*) = most supreme all-pervading through Space (Bramn in this context), सो**[3]** (*so*) = He, अङ्ग (*ang*) = existence in reality, वेद (*ved*) = has complete/true knowledge of, यदि वा न (*yadi vaa a*) = and when this (*srishti*) does not exist, that too, वेद (*ved*) = has true knowledge of ॥

**Mantra Translation:**

*"True knowledge of wherefrom this multifarious srishti (creation) originates, who sustains it and ultimately when it ceases to exist, is with its Controller**[1]** the most supreme all-pervading Brahmn**[2]**. He**[3]** has complete knowledge of its reality when it is in existence and even when it is not."* (RigVeda, 10/129/7)

**Mantra Interpretation**

The theistic emphasis in this mantra is obvious. The term विसृष्टि: (*vi-srishti*) for 'diverse creation' is in the sixth mantra and repeated in the seventh mantra as well. This term draws a contrast between the term *Salilam* and *Svadha* both being the Nature entity. Whereas the term *Salilam* in the third mantra is used for Nature in the pre-creation phase, in uniform indefinable *Asata*-state, the term *Svadha* in the creation phase, used in the second and fifth mantras, represents the 'diverse creation' in the *Sata*-state of Nature. The presence of the all-pervading Consciousness-field through the created universe is the main theme of the 7th (last) mantra of the *Bhavavrittam sukta*. An entity such as God according to some famous cosmologists is unnecessary and the all-pervading gravitation due to mass in matter is the Creator-field of the universe. The property of gravitation (mass in matter) for the Vedic premise is only one of the seven primary inert *devas* that help create the universe. Modern cosmology for example cannot create a universe without the *Indra-devata*, the property of electricity in the universe. In the atheistic reference frame there are no satisfactory answers to the questions raised before – why is there mass in matter and when did nature determine how much mass to put in a proton or an electron? The Vedic answer to such questions are in the above mantra, that the "*True knowledge of wherefrom this multifarious srishti (creation) originates, who sustains it and ultimately when does it cease to exist, is with its Controller*[1] *the most supreme all-pervading Brahmn*[2].

The term अध्यक्ष:1 (*adhyakshah*) in the mantra is for one who exercises supervision, control and presides over all others; a common translation of it being 'the president'. The term is applicable to a conscious-being. This mantra's thoughts are also a reinforcement of the consciousness principle expressed in the second mantra (RigVeda, 10/129/2) where, in addition to the inert Nature, also existed तदेकम् तस्माध्दान्यन्न पर: (*tadekam tasmaaddhaanyann parah*) "*the unique One, none like Him and nothing beyond Him",* the Brahmn. Among the inert *devatas* of the Vedas, the Sun *devata* for instance is the controller, sustainer of the Earth and the rest of the solar system through its gravitational force and heat energy. However, the term अध्यक्ष:**1** (*adhyakshah*) cannot be used for the Sun. In the mantra the term सो**3** (*so*), which is the same as सः (*saha*), stands for 'that'. The usage of सो**3** (*so*), according to the Sanskrit grammar (vibhakti rule), is for a

conscious-being, not for an inert entity such as the gravitation, Space-entity or *Prakriti* (Nature). The Sanskrit grammar rule of *tritiya-vibhakti* (third-*vibhakti*) is used for an inert entity such as the Sun, Nature or gravitation. Consequently, the English translation for सो३ (*so*) can be He or She and not 'it'. The Vedic pronouncements always being meaningful, it is clear that the emphasis in the above mantra is for the Conscious-being Creator.

The Conscious-being addressed as एकम् (*ekam*) in the previous mantras (RigVeda 10/129/2, 3) is addressed as परमे व्योमन्[2] (*parame Vyoman*) in the seventh mantra. The terms पर: (*parah*) or परमे (*parame*) before the term *vyoman* are synonym adjectives, meaning "*most primary* or *most supreme*". The term *parame vyoman* thus means – *one who is most supreme and pervades through all like the Space-entity*. The *parme vyoman* is the term for the all-pervading supreme *Brahmn* – "*… He[3] has complete knowledge of its reality when it is in existence and even when it is not"* points to the fact that the *Vyom* in the context of this mantra is for the all-pervading Consciousness-field Brahmn and not the inert Vyom, the Space-entity. Also, having knowledge is a trait only in conscious-beings.

The deductions from the last two mantras are as following.

**Deduction from the Mantras (RigVeda 10/129/6, 7)**

- (16) *Devas* are the source of knowledge of the birth of the universe.

- (17) Complete knowledge of the creation of the universe has human limitations. This is one of the 'exclusion principles of the Vedas'.

- (18) The universe is a *srishti* (a created phenomenon) under the Conscious Creator Energy Field. The complete knowledge of creation is preserved in the Creator. The human limitation allows only partial knowledge of the creation.

- (19) *Srishti* is the real existence of matter in its *Sata*-state and *pralaya* is its indefinable *Asata*-state.

The deduction drawn from each mantra of the *Bhavavrittam* (History of Creation of the Universe) *sukta* of the RigVeda (10/129/1-7) relates to the creation of the universe and the subject of cosmology. All seven mantras together delineate a qualitative yet vivid picture of the pre-onset and post-onset epochs of the universe and will form the basis for the Vedic creation scenario developed in Chapters 7 to 10. The universe in its pre-onset period of *pralaya* is in the likeness of a thick dark gravid fog of indefinable matter in its *Asata*-state with none of the defining features of *srishti* (creation) at present. The Creator is credited for initiating the universe with His (काम: = ईक्षण; *kaamh =eekshana*) mind-energy (RigVeda 10/129/4) as well as **तपसः** (*tapasah*) the heat energy (RigVeda 10/129/3). The transition of matter at the moment of the onset of creation causes the *vitatah*-expansion (instantaneous explosion) omni-directionally sending out the rays of minute corpuscles of matter (*retodha*) at their fundamental level, all connected in a network. That these *retodha*, served as the ultimate cause for the formation of 'great objects' of cosmos, is an important principle emphasized by the Veda under its Vedic Cosmology Principle, indicating the coagulation of matter as the prime mechanism for the formation of the great celestial objects and the galaxies.

After the 129$^{th}$ *sukta* of the 10$^{th}$ *mandal* (chapter) of RigVeda discussed above, the very next *sukta* 130 of the same chapter of RigVeda also has *Bhavavrittam* ("***History of Creation of the Universe"***) as its *devata* (subject). The *rishi* of this *sukta* with 7 mantras is Yagjyaha Prajaapatya. The first two mantras of this *sukta* have direct relevance to the physical aspect of the universe that one talks about in the context of modern cosmology. The mantras formulate that the created universe is a knitted and cloth-like system that spreads out in all directions during the creation phase.

Mysteriously the mantras make a reference to the 101 physical systems/forces/processes essential to create and sustain the universe and enable its evolution. The mantras also state that this spread-out "cloth of the universe" is collected back when the end of the creation approaches. The first two mantras of the 130th *sukta* are in what follows:

**RigVeda Mantra (10/130/1)**

यो यज्ञो[1] विश्वतस्तन्तु[2]भिस्तत एकशतं[3] देवकर्मेभिरायतः[4]।
इमे वयन्ति5 पितरो य आययुः प्र वयाप वयेत्यासते तते॥
(RigVeda, 10/130/1)

**Transliteration:**

"Y*o yagjyo vishvatastantubhistat ekshatam devakarmebhiraayatah*.
*Ime vayanti pitaro ya aayayuh pra vayaap vayetyaasate tate*."

**Word Translation:**

**यः** (*yaha*) = this (universe), **यज्ञः**[1] (*yagjyah*) = yajna of creation, the process that benefits all, **विश्वतः** (*vishvatah*) = throughout the universe, all around, **तन्तु**[2] (*tantu*) = a minute strand being the foundational cause for the whole weaved cloth, the cause of growth, the cause of expansion - all meanings apply, **तन्तुभिः** (*tantubhih*) =from the strand, **ततः** (*tatah*) = has been spread out, **एक शतम्**[3] (*ek shatam*) = 101, **देवकर्मेभिः** (*deva-karmebhih*) = owing to the dynamic actions of the devas, **आयतः**[4] (*aayatah*) = spread over a great area. **I**

**इमे** (*ime*) = these, **वयन्ति**[5] (*vayanti*) = weave, **पितरः** (*pitarah*) = most ancient progenitors, **ये** (*ye*) = which, **आययुः** (*aayayuh*) = pervade in the universe, **प्रवय** (*pravaya*) = (inspiring to) weave upwards, **अपवय** (*apvaya*) = (inspiring to) weave downwards, **इति असते** (*iti asate*) = in this manner they remain in perennial action in it, **तते** (*tate*) = when it happens (when the universe is stretched out). **II**

**Mantra Translation:**

"*All through the universe, the process of creation is a selfless act of yagjya* (**यज्ञः**[1]) *performed step by step in association with the ever-active 101* (**एक शतम्**[3] = *ek shatam*) *devas. Just as a tantu* (**तन्तु**[2] = strand) *is fundamental to weaving a spread-out cloth, the universe in its vastness* (**आयतः**[4] = *aayatah*) *is woven like a cloth availing the devas - the most ancient progenitor powers, pervading through the fundamental strands of this universe. The devas are inspired to weave* (**वयन्ति**[5]) *this universe upwards and downwards. In this manner the deva-systems remain in perennial action even when the universe is spread out like a cloth"*. (RigVeda, 10/130/1)

**Mantra Interpretation**

There are several subjects invoked in this mantra. The author wishes to draw the reader's attention towards the five specific items superscripted from 1 to 5. In this and several other mantras the creation of the universe by the Creator is termed as a *yagjya* (**यज्ञः**[1]). A common definition of the term *yagjya*, alternately also written as *yajna*, was presented in Chapter 3 to mean - '*any action requiring association of men or objects and productive of beneficial results'*. A *yagjya*, when performed by humans is never an accident – it is a well-planned activity with fire-oblation and mantra recitation. The creation of the universe is considered to be the effect of the Creator's *Eekshana* (visualization, thought and desire) wherein the advent of the creation is a tremendous fire-oblation resulting in the physical universe for the benefit of living beings.

In this mantra, the universe is compared to a spread-out vast cloth covering a large area (**आयतः**[4] = *aayatah*). Therefore, the indication here is that the universe is a flat sheet than a sphere. Just as the minute strands (**तन्तु**[2] = *tantu*) are the fundamental cause for the entire cloth, the universe, in the simile of a stretched-out cloth, is weaved strand-by-strand. An implicit message in the mantra is that the entire universe is made up of minute fundamental particles of matter that are woven together sequentially,

indicating that this vast sheet of the universe was weaved over a period of time, meaning that the universe is not an instantaneous expanded entity. Also, just as all strands in a cloth are tied to each other, all matter of the universe is tied together and connected.

Master Weaver – the Creator, utilizes 101 (**एक शतम्**3 = *ek shatam*) specific forces of Nature to weave, **वयन्ति**5 (*vayanti*), upwards and downwards the vast spread-out cloth - the universe! These 101 *devas* are said to be the most ancient, meaning that after the onset of creation they are the first byproducts of Nature and some of them are all-pervading through the created universe and will continue to sustain the universe. Earlier a group of seven *devas* as the first progeny of Nature was mentioned. This mantra states a set of 'active 101 *deva*'. The mantra has not revealed the mystery of these 101 active *devas* that are instrumental in weaving the universe. Without going into the details and references of other mantras related to the *devas*, it should suffice here that the 101 *devas* according to the publication by the Arya Pratinidhi Sabha of the RigVeda translation are: 8 *vasu*, 12 *aaditya*, 11 *rudra*, 11 *vishvadeva*, 49 *maarut* and 10 *vishva-srij*.

The second mantra related to the creation of the universe is:

**RigVeda Mantra (10/130/2)**

पुमाँ एनं तनुते1 उत्कृणत्ति2 पुमान्वि तत्ने3 अधि नाके4 अस्मिन ।
इमे मयूखा5 उप सेदुरु सदः सामानि चक्रुस्तसराण्योतवे6 ॥

(RigVeda, 10/130/2)

**Transliteration:**

**"***Pumaam enam tanute ootkrinatti pumaanvi tatne adhi naake asmin* ।

*Ime mayookhaa oop seduru sadah saamaani chakrustsaraanyotave* ॥"

**Word Translation:**

**पुमाँ** (*pumaam*) = the unitary all-pervading unitary spirit itself (the Creator), **एनम्** (*enam*) = to this creation, **तनुते**1 (*tanute*) = stretched like a cloth, **उत्कृणत्ति**2 (*ootcrinatti*) = gathers together in time, **पुमान्** (*pumaan*) =

the Creator Himself, **तत्ने**[3] (*tatne*) = stretches or expands (both meanings apply), **अस्मिन्** (*asmin*) = within this, **नाके अधि**[4] (*naake adhi*) = within the vast Antariksh (*Space*) ।

**इमे** (*ime*) = these, **मयूखाः**[5] (*mayukhah*) = beams of light / waves of energy / the strands of energy / pegs to stabilize (all meanings apply), **उप सेदुः** (*oop seduh*) = are utilized, **सदः** (*sadah*) = in this Space of action, **ओतवे** (*otave*) = for weaving this cloth of creation, **सामानि** (*saamaani*) = material, **चक्रुस् तसराणि**[6] (*chakrus tasraani*) = the action of casting upwards and downwards in the context of the cloth on the loom. ॥

**Mantra Translation:**

*"The Creator Himself stretches* (**तनुते**[1] = *tanute*) *this universe like a cloth and gathers it together* (**उत्कृणत्ति**[2]) *in time (at the time of pralaya = dissolution). The Creator-self stretches (expands =* **तत्ने**[3]) *this universe over the vast Space (Antariksh =* **नाके अधि**[4]). *The process of creation is accomplished utilizing the beams of light (waves of energy =* **मयूखाः**[5]) *as pegs to hold the universe. The action of creation is like the cloth on the loom* (**चक्रुस् तसराणि**[6]), *weaving upwards and weaving downwards".* (RigVeda, 10/130/2).

**Mantra Interpretation**

The previous mantra mentioned 101 different forces and systems of Nature that serve as implements to shape the universe in the form of a sheet of cloth. This mantra differentiates, as the other mantras in the previous *Bhavavrittam sukta*, between the 'material-cause', the inert Nature (the inert 101 *devas* being part of it) and the 'efficient-cause', the Creator.

Both mantras are very specific in stating that the universe is like a flat stretched-out sheet, like a cloth that has been stretched to its vastness by the Creator-energy-field. With a difference in terminology, the modern Big Bang states that the all-pervading Dark Energy is responsible for the on-going expansion of the universe. Another remarkable statement in these mantras is that the universe is like a stretched out cloth and the 101 *devas*

are perennially engaged in the same process – meaning that the universe was initially expanded by the Creator and it is still being expanded.

Considering that it is important for contemporary cosmologists to determine what the shape of the universe is, the beauty of this ancient mantra is that it discusses the shape of the universe. Out of the three possible shapes of the universe - the spherical, the horse-saddle and flat, the present universe is observed to be a flat sheet, just as it is stipulated by the mantra millennia ago!

Based on the mantra references on Vedic Big Bang it will be shown in Chapter 7 that the universe initially began in the shape of a sphere confined in diminutive Space and it expanded under the influence of the tremendous heat energy and flattened under the vigorous initial rotation.

**Deduction from the last two mantras**

- (20) To create the universe one also needs to create fundamental forces and systems (*devas)* in Nature that would enable the creation to proceed in the positive direction.

- (21) The universe is like a stretched sheet of cloth in dynamic state, continuing to stretch with all the matter in it tied together like the strands of a woven cloth.

What happens next in the *srishti* (creation) is the subject of three mantras in chapter 10, *sukta* 190 of RigVeda, with its subject also being *Bhavavrittam*.

**RigVeda Mantra (10/190/1)**

The three additional mantras under the *sukta* 190 of the chapter 10, revealed to Rishi Aghmarshano Madhuchchhandasah, also in the *Bhavavrittam sukta* (***History of Creation of the*** **Universe)** complement the above 9 mantras. Through these mantras the प्रकेत: (*praketah* = the defining symbols) of the second mantra (10/129/2), the beacons of the universe in the form of महिमान: (*mahimaanah*) the great objects of cosmos that were absent in *pralaya,* are brought into perspective. These mantras establish a

union between the theoretical Vedic Cosmology Principle and the observed reality of the महिमान: (*mahimaanah*) of the universe. These महिमान: (*mahimaanah*) include the great objects of the universe such as the Earth, the Moon, the Sun, Dyu the abode of cosmos, the 'oceans of deep space' and so on, all bound to the Time-entity.

च सत्यं चाभीध्दात्तपसोऽध्यजायत ।
ततो रात्र्यजायत तत: समुद्रो अर्णव: ॥ (RigVeda:10/190/1)

**Transliteration:** "*Ritam cha satyam chaabheeddhaattpaso addhyajaayata |*
*Tato ratryajaayata tatah samudro arnava ||*"

**Word Translation:**

ऋतं (***ritam***) = Creator's laws for creation in both realms, spiritual and material (defined in Chapter 5), च (*cha*) = and, सत्यं (***satyam***) = Creator's laws for governing the Nature in the creation phase, च (*cha)* = and, अभीध्दात् (*abheeddhaat* ) **=** all-illume Creator, तपस: (**tapasaha) =** from the heat-form of energy**,** अधि अजायत *(adhi-ajaayat)***=** day of creation comes into existence |

तत: *(tatah)* **=** from the same**,** रात्र्य अजायत *(raatrya-ajaayat)* **=** the night of the creation cycle (dissolution phase of Nature)**,** तत: = from the same**,** समुद्र**:** (**samudrah ) =** the ocean of space or the Space by itself, अर्णव: (**arnavah) =** the ocean of water ॥

**Mantra Translation**

*"Under All-illume Creator's **ritam** and **satyam** rules* (rules governing spiritual and material creation) *and His **tapasaha** the heat form of energy, the Nature comes into its day-epoch of creation, creating the vast oceans of space (vast regions of Space) and the oceans of water. The Nature under the same*

*rules recedes into its night-epoch of dissolution. ".* (RigVeda, 10/190/1).

**Mantra Interpretation**

The first line of this mantra was used in the beginning of the Chapter 5 where the terms ऋतं (***ritam***) and सत्यं (***satyam***) were defined. The term *ritam* encompasses the *Creator's preexisting rule of the creation and dissolution* and the *satyam* stands for the *'Creator's rule under which matter of the universe comes into physical existence and functions thereon obeying physical laws manifest in the created universe'*.

Since *the Svadha* (Nature) in the Vedic process of creation (RigVeda, 10/129/5) "*…is subordinate and the Creator's inspiration is paramount,* the *ritam* being the Creator's inspiration encompasses the spiritual realm as well as the *satyam* and all physical laws under it. Therefore all objects and systems in the created universe are primarily under the Creator's *ritam*. The usage of both terms successively in the same mantra implies that the two principles are different and that the *ritam* in association with *satyam* creates the universe.

A straightforward interpretation of the RigVeda mantra (10/190/1) is that under *ritam* and *satyam* the creation is not an arbitrary, random phenomenon. As mentioned a number of times, the Creator's inspiration to create rises out of the Creator's *Eekshana* with '*visualization, thought and desire that enable a conscious being to create tangible things*'. This takes the arbitrariness out of the process. For a moment if one sets aside the *eekshana* of a conscious being which also initiates action to create tangible things, one observes in Nature that there is always an underlying ultimate cause for a physical phenomenon and no phenomenon occurs without the presence of preexisting physical laws. There is nothing arbitrary and random in the universe. The 'effect' cannot be without its pre-existent 'cause' and therefore the space-time singularity of the modern cosmology must have its real 'cause' if it were to come into existence.

The other important outcome of the mantra is the universe's temporal relationship to the 'rules of creation' the *ritam* and *satyam* through अधि अजायत *(adhi ajaayat)* and रात्र्य अजायत (*raatrya ajaayat*), conveying the cyclic order of *Brahmn*'s day (the creation epoch) and Brahmn's night (the

dissolution epoch) respectively for the creation and the dissolution of Nature. The *ritam* of the Creator is thus the primary all-encompassing principle in Vedic Cosmology; other complementary subordinate rules are revealed in this and the other mantras.

The RigVeda mantra (10/129/2) establishes the causes of creation of the universe: the 'efficient-cause' is एकम् (*ekam*) the Creator and the 'material-cause' is स्वधा (*svadha*), the Nature. The RigVeda mantra (10/190/1) relates the Vedic Cosmology Principle to the tangible universe. In this mantra as in other mantras, the bare-essentials for creation are two entities: the Creator and Nature.

It is emphasized in this mantra that in addition to the spiritual *Eekshana* energy that the Creator imparts to the 'material-cause' to awaken each matter particle, the Creator imparts the physical form of energy also, the ***tapasaha***. The physics term ***tapasaha*** or *taaph* stands for heat energy. Imparting of the heat form of *taaph* energy to the primordial matter of the universe was also emphasized in the RigVeda mantra (10/129/3) discussed earlier. Therefore, the initial associative-cause of creation is the heat energy that sends the entire inactive *Asata*-state of matter of the *pralaya*-phase into its active *Sata*-state (*satyam* → *Satah*) in the *sarg* phase – the *srishti*.

The supply of heat energy into the raw material of the universe leads to the hot matter conglomerate addressed with several adjectives in the Vedas, such as the *Hiranya-aand* (Golden-embryo), *Brahm-aand* (Creator's-ovate), *Maart-aand* (Mortal-ovate) and so on to be discussed in the Vedic Creation Scenario developed in Chapters 7, 8 and 9. This hot primordial universe, after rotation-in-floatation (*paryaplav*), develops tremendous heat energy for a definite Veda assigned period of 4.32 million years when it explodes into uncountable hot pieces (RigVeda, 10/129/5 and more references in Chapters 7 to 9). Ultimately they form the the star systems (galaxies) and the planetary systems while stretching the Space-entity and create vast inter-galactic space. The Vedic term for the vast inter-galactic space is समुद्रः (*samudrah*), the 'ocean of space' and the word अर्णवः (*arnavah*) conveys the vast oceans of water on Earth and Earth-like terrestrial systems. The two words for 'ocean' used simultaneously in the same mantra stand for two different kinds of oceans: the space as a vast ocean and the terrestrial vast ocean of water on the Earth. In the Vedic *yaugik* meaning the term *samudrah* represents the extra-terrestrial ocean of space, while *arnavah* is

specific to the oceans of water on the Earth even though both words are commonly used for the ocean on the Earth.

While discussing the Space-entity in Chapters 1 and 5, it was mentioned that the Veda used the adjective of a 'flower' for the Space-entity because from its initial diminutive confinement before the onset of creation it swells like a bud and expands like a flower. In this mantra the Space-entity is addressed as a vast 'ocean' with the adjective of समुद्रः (*samudrah*) because all celestial bodies float on it like boats and ships float on the surface of an ocean. Further reading into Vedas and Vedic Literature leads one to understand that *samudrah* is an adjective for the spread out continuity of brilliant matter in the splendor of galaxies. The adjective describing 'waters of space' has also been used for our Milky Way Galaxy. The Milky Way Galaxy being a stretched out brilliant region of the sky, confined in a relatively narrow bend of the sky, is termed in Vedic Literature as '*Aakash Ganga*', which means the River Ganges of the space.

We learn from the modern Big Bang Hypothesis that about 100 seconds after the Big Bang, when temperature of the primordial universe dropped from infinitely high to about $10^9$ ºK (1 billion ºK), the nucleosynthesis begins to form Hydrogen and Helium and the early universe ends up with about 75% Hydrogen and only about 25% Helium. The bigger atoms are also formed to create other substances such as water from Hydrogen and Oxygen, leading to the formation of the vast ocean on the Earth and on other terrestrial planets. Although the Creator's *taapah* (heat-energy) in this and the earlier mantras does not refer to a temperature of the universe at its beginning or at a later stage, it is implicit that it would be very high. It is explicitly stated in numerous mantras that the primordial universe was extremely hot. This is consistent with the mantra statements because the supply of heat to the entire universe for each fundamental particle in it to transit from a static to a dynamic state required an incredible high level of heat energy. The supply of high level energy was implicit in the process, especially when all the matter of the universe was confined in a diminutive space the *tuchchhayen-Aabhu* (compact Nature, RigVeda, 10/129/3), with extremely high matter density.

As mentioned earlier, if all particles of matter come together without any inter-space between them and it is assumed that the density of the universe is the same as the density of a single proton, the universe is as dense as 100 trillion times the density of steel. To explode such dense

matter to turn it into rays of fundamental particles (*retodha*), an unimaginable, tremendous amount of energy was needed. Additionally a sudden expansion of space (RigVeda, 10/129/5) also means a supply of heat at high temperature. On account of heat and confinement of matter in *tuchchhayen*-space, one can see considerable parallelism between the modern Big Bang Hypothesis and the ancient Vedic Cosmology Principle, the difference obviously being in accreditation. The Veda accredited the all-illume Creator for the supply of the heat energy whereas the Big Bang Hypothesis has its beginning in the preexistence of infinitely high temperatures.

**Deductions from the mantra**

- (22) The creation process of the universe and all of Nature's laws in the functioning universe are contained in the general Vedic Cosmology Principle called *ritam* and all the laws under the spiritual and physical realms of creation are under the *ritam* and the *satyam* rules. The cyclic universe is the invariant feature of the Vedic creation.

- (23) After the initiation of *Eekshana* energy of the Creator into the primordial *Asata*-state of matter of the universe, the physical **heat energy** (*taapah*) developed in the matter conglomerate of the primordial universe, accredited by the mantra to the Creator-Energy-Field, leads the matter to shape the universe.

**RigVeda Mantra (10/190/2)**

The second RigVeda mantra (10/129/2) of the first *Bhavavrittam sukta* stated the concept of Time in differing ways using the term *praketam* for non-changing beacons and indicators of the created universe such as the Sun, the Moon, the constellations and the directions in space. Rishi Kanaad in his Vaisheshik *sutra* (1/2/6) listed five basic *lingas* (defining symbols) of the Time-entity (discussed in Chapters 1 and 5 under the "Time-entity") and

the term तर्हि (*tarhi* = at that time or then) in the RigVeda mantra (10/129/2) discussed above render a context of night (*raatrya*) and day (*anha*), which are also the defining symbols of the creation. They all lead to the concept of Time. In that aspect the second mantra of the third *Bhavavvrittam sukta* (190th) takes us a step forward. The mantra instructs one to observe the *lingas* of the creation and their relationship to Time in terms of the 'time-cycle', the 'time-division' and the 'time-scale'. The mantra introduces the concept of Time measurement and periodicity that bind all the created objects of Nature.

समुद्रादर्णवादधि संवत्सरो अजायत ।
अहोरात्राणि विदधद्विश्वस्य मिषतो वशी ॥(RigVeda, 10/190/2)

**Transliteration:** "*Samudraadarnvaadadhi samvatsaro ajaayata |*
*Ahoraatraani vidadhadvishvasya mishto vashi ||*"

**Word Translation**

समुद्रात् (*samudraat*) = from oceans in space (the Space as the vast ocean)**,** अर्णवात् (*arnavaat*) = from oceans of water**,** संवत् सर**:** (*samvat-sarah*)**=** Time-cycle or rule of time division, अध्यजायत *(addhyajaayat)* = comes into existence, अहो रात्राणि (*aho raatraani*) = (differentiation) of the day and night, विदधत् (*vidadhat*) **=** creates, विश्वस्य (*vishvasya*) **=** of the universe, मिषत**:** (***mishatah***) = concept of minute time division related to eye-lid blink time of humans, वशी (*vashi*) = Controller.

**Mantra Translation:**

*"The Controller of the universe reveals from the ocean of Space and the terrestrial ocean the concept of Time-entity, its periodic nature in samvatsar with the day-night cycle and from the large to minute time-division of nimesh. He reveals these through His ceation of the animate and inanimate* (RigVeda, 10/190/2).

The practical units of time have been the subject of other mantras as well; some were discussed in Chapter 5 under the Time-entity. This mantra states qualitatively about the concepts of time-cycles and time-scales. The living-beings will have the concept of time and its division only when the markers of this creation, like the Sun, the Earth, the Moon and the constellations appear and move in a uniform, periodic and controlled order.

The Veda credits this non-chaotic cyclic behaviour of the cosmos to the Controller and His *ritam* and *satyam* system. Modern cosmology on the other hand credits Nature and its physical laws (*satyam*) for all activities and systems including the time cycles (*samvatsar*). The situation is not as cut-and dry as "what's in a name" where the name 'creator' could be replaced by the term 'nature'. It is a matter of philosophical consideration which cannot be avoided. Are the reins controlling the horses of the chariot, or, is the charioteer controlling the horses using the reins? In the Vedic thought, both the Creator as a controller and Nature as the controlled are needed for exhibiting creation and the time-cycles in it through the *lingas* of creation.

The concept of time of course has no meaning without the advent of intelligent beings on Earth and their observation of the universe from the Earth's frame of reference. This applies also to the intelligent beings on another exo-planet and that exo-planet's frame of reference. A living being correlates time to his/her own survival and to the span of his/her life. The living-being also extends the measure of time to other permanent objects of creation like the Sun, the Moon and the stars. The reference to the space-ocean in the mantra relates to the repeatability of time-cycles in the cosmos and constellations and the reference to the terrestrial ocean relates to the periodicities related to the Sun and the Moon. The periodicity related to the Moon is observed and correlated with the lunar phases and the other terrestrial phenomena like tides in the terrestrial ocean.

A remarkable outcome of the mantra is that the large scale time-cycles, defined as *samvatsar,* relate to the outer space and the illuminated objects therein such as the Sun, the Moon and the constellations that are far away from the Earth and the minute time scale relates to the term *mishat* in the mantra which means the motion of the eye-lid of a human being. The term *nimesh,* the unit of time in milliseconds introduced in Chapter 5 under the Time-entity, is a derivative from the term *mishat* where *nimesh* is the time of the downward blink of the upper eye-lid. The terms *samvatsar* and

*nimesh*, discussed in detail under the Time-entity in Chapter 5, encompass the Vedic time-scale of the Aryans from one end of the scale to the other. While the *samvatsar* (Table 5.3 in Chapter 5) defined a period as big as one year in the context of the Sun-Earth system and a *maha-yuga* of 4.32 MY (million years) in the context of the creation period of 4.32 BY (billion years), the *nimesh* was defined as the $18^{th}$ part of a *kaashtha* and it turned out to be $8/45^{th}$ of a second (Table 5.5 in Chapter 5) as the time of a blink of a normal human eye. The above mantra obviously relates the time measurement to the minute time phenomenon, occurring in human physiology and also to the large-scale time measurement of phenomena occurring far away in space.

The reference to *nimesh* in the above RigVeda mantra is only qualitative, nevertheless, the Veda practically tells the reader to go and measure the blink-time of an eye to get a small time division and call it '*nimesh*'. And then relate that to other time divisions for knowledge enhancement! The ancient Aryan *rishis* took the advice of the mantra, carried out experiments with the blink of the human eye-lid and furnished the quantitative time unit of *nimesh*. This author, using the references from the YajurVeda (23/3), Manusmriti (1/64) and contemporary developments in time measurement technology, discussed in Chapter 5 'The Mind-Boggling Case of Nimesh'. The ancient *rishis* called the time of one revolution of the Earth around the Sun as the Earth's *samvatsar* and divided it into 360 days leading to 360º in a circle. They divided one अहो रात्राणि (*aho-raatraani* = day-night) period mentioned in this mantra, into 8 *prahara* (modern 24 hours) and other divisions (see Table 5.5 in Chapter 5) and finally said that there were 86400 *nimesh* in one अहो रात्रि (*aho-ratri*).

**Deduction from the Mantra**

- (24) Samvatsar, the periodicity of cosmological bodies and phenomena, is inherent in the universe at all its levels and in all regions of the universe.

The last mantra of the third *Bhavavrittam sukta* of RigVeda takes us from *nimesh* and *samvatsar* to yet a larger unit of time, the *kalpa* that was

also defined earlier to be the creation-epoch which is opposite to a *vikalpa*-epoch of dissolution.**RigVeda Mantra (10/190/3)**

सूर्याचन्द्रमसौ धाता यथापूर्वमकल्पयत् ।
दिवं च पृथिवीं चान्तरिक्षमथो स्व: ॥ (RigVeda, 10/190/3)

**Transliteration:**

**"***Suryachandramasau dhaataa yathaapoorvam-akalp-yat । divam cha prithveem chaantarikshmatho svah ॥*"

**Word translation:**

सूर्य (*surya*) = the Sun**,** चन्द्र (*chandra*) = the Moon, असौ **(***asau*) **=** and so on/similar to**,** धाता (*dhaataa*) = Creator the upholder, यथापूर्वम् (***yathaapoorvam***) = like before , कल्प **(*kalp*)** = the creation-epoch with definite time duration, यत् (*yat*) = is in continuity, अकल्पयत् (*akalpayat*)= creates ।

दिवं (*divam*)= Dyu the illuminated region of space, च (*cha*) = and , पृथिवीं (*prithivieem*) = the Earth, च (*cha*) = and, अन्तरिक्षम् **(***antariksham*) = The Space, inter-space of cosmos, अथो (*atho*) = used for emphasis, with certainty, स्व**:** (*svah*) = All-pervading creator and upholder of all illumine substances.॥

**Mantra Translation:**

*"The Creator and upholder of this universe has created in this **kalpa** all-illumine cosmos, dyu the illuminated region of space, antariksham the abode of the Sun, the Moon, the Earth and other cosmic bodies and will continue in future the cycle*

*of creation in a semblance of the previous* ***kalpa***." (RigVeda:10/190/3).

**Mantra Interpretation**

A clear declaration of the mantra is the sempiternal cyclic nature of the process of creation and dissolution. The mantra with the usage of two terms together, कल्प (*kalpa*) and यथापूर्वम् (*yathapoorvam*) means – 'the creation-epoch as before', proclaiming the Vedic principle of sequential multiple creations. On a linear timeline, the multiple *kalpas* (creations) are possible when they are separated by successive multiple *vikalpas* (dissolution-phases). Thus the Vedic creation-dissolution is a cyclic phenomenon with the present creation of the universe being one of many that have preceded it and many to come. For this to happen the Time-entity must be an infinite continuum in both directions; in the past and in the future, an eternal entity.

To represent this in terms of time, the present $n^{th}$ universe began at time $t = t_n$ and not at $t = 0$ second, as in the Big Bang Hypothesis. The term *kalpa* in this mantra exclusively relates to the time definition of the universe when it is in the creation phase. Earlier the Vedic term *vikalpa* was also defined, that it is the dissolution epoch of the universe when the Nature goes back into indefinable *Asata*-state of matter and is confined in *tuchchhaya* (diminutive) space. Since the *Asata*-state is opposite of the *Sata*-state of matter, the prefix '*vi*' before *kalpa* renders the term *vikalpa*. The time division of a *kalpa* in terms of the harmonics of *yuga*-cycles was presented in the Table 5.3 in Chapter 5. In the Vedas the building material of the universe is the sempiternal Nature. The *Sata*-state of matter in the creation phase of the universe and the *Asata*-state of matter during the dissolution phase, appear successively in a cyclic order of *kalpa-vikalpa* which rides on the '*un-aging-horse of the Time-entity*' sempiternally.

In the above mantra, a reference is made about the creation of two types of entities, substantive cosmic bodies such as the Sun, the Moon, the Earth and all illumine cosmos and the non-substantive division of the regions of the universe such as the *Dyu* (illuminated region surrounding the Sun) and the अन्तरिक्षम् (*antariksham*) the vast Space-entity itself, the abode of all celestial bodies. The mantra emphasizes that all objects and the regions of space in the present creation are in the semblance of all those

creations that took place before. Also with reference to the RigVeda mantra (10/190/1) all successive creation-dissolution sequences are carried out under the same set of rules of the Creator, the *ritam* and *satyam*. The living creation throughout the universe (including the exo-planets, YajurVeda, 17/2, discussed in Chapter 1, Volume 1), is also a component of this Vedic creation-dissolution cycle.

**Deduction from the Mantra**

- (25) The universe is a cyclic phenomenon that occurs in semblance of the previous *kalpa* with cosmic bodies and the illuminated divisions of space.

# Commentary on the Bhavavrittam (Creation) Suktas of RigVeda

The twelve mantras from the three *suktas*, 129, 130 and 190 of the 10th chapter of RigVeda on the subject of *Bhavavrittam* ('History of Creation of the Universe') presented the major constituents of the Vedic Cosmology Principle where the entities taking part in the creation are named with their

functions and the process of creation is depicted. The Conscious Creator-Energy-Field triggers the creation in inert Nature confined in a *tuchchhaya* (diminutively small) Space, the Nature corpuscularized (quantized) at its fundamental level serves as the raw material for the universe. After the order in the creation is established and the celestial bodies are formed to sustain the *birth-death* process in the creation, which was absent (RigVeda, 10/129/2) before in the *Asata*-state of the Nature, the quantized consciousness, the souls, emerge in the universe as the living-creation. It is the consciousness quanta with cognitive ability in their physical bodies that begin to observe the resplendent universe discovering the cause-effect relationship in the phenomena of Nature, the time cycles (*samvatsar*) in celestial bodies and ultimately wonder how all this came about. The process of intellectualization begins, the *Bhavavrittam suktas* are populated with mantra formulations and the modernization of the thought process continues. Thus the advent of *srishti* (creation) becomes meaningful.

The mantras in the *Bhavavrittam suktas* differentiate between the conditions of Nature in the *pralaya*-phase, when it is dense, devoid of radiation, confined in diminutive space and is without a distinction of 'what covered what' and in the *srishti*-phase, when matter becomes observable and spread-out, creating tremendous diversity in Nature (RigVeda, 10/129/1, 3). The *suktas* also suggest that this perennial cycle of *srishti* and *pralaya* is not an accident (RigVeda, 10/129/4) at a random point in time, as at time-zero of Big Bang. The *sukta* 190 by another *rishi* with its three mantras also substantiates the principle of the cyclic nature of the universe with the emphasis that it takes place यथापूर्वम् (*yathaapoorvam* = in the same manner as before) again and again. Under the Vedic *ritam,* the rule of creation, the laws of nature do not change and the creation mechanism itself remains an invariant. Rishi Kapil in his Saankhya Darshan expressed the same thought thus - इदानीमिव सर्वत्र नात्यन्तोच्छेदः (*Idaaneemiv sarvatra naatyantochchhedah*, 1/124). This in the context of his other sutras means – ***"The creation that is presently continuing everywhere does not vanish completely (into nothingness)".*** Implicit in this statement is the negation of the argument that the universe at one point disappears completely into nothingness. Rishi Kapil asserts that the universe dissolves but does not vanish completely into nothingness. It therefore also implies that the creation and dissolution of the universe is a never-ending eternal process.

He implies that what is seen everywhere as the creation, is a part of the eternal cycle with its state changing. He also stated in his well-known *sutra* (1/26) that the present creation is from the *saamyavastha* (completely dissolved state) of Nature. In yet another *sutra* Rishi Kapil also stated that *"Nothingness cannot be the cause of something"* (Sankhya, 1/43) and therefore the creation has to begin with pre-existence of Nature, the state of Nature being the *Asata*-state as defined by the Veda. The most important deduction from the Veda mantras is that the state of Nature switches from one state to the other within the eternal creation-dissolution cycle.

The *sukta* clearly states that the universe has an explosive beginning, spreading (vitatah) in all directions with all the matter of the universe tied together in a network seeded by minute fundamental particles (RigVeda, 10/129/5) that evolve into large cosmos. Just as in a net the pressure applied on a single knit is felt on all its knits, all matter of the universe is said to be tied in an integrated network. This in physics terminology could be explained as - all particles of the universe exert gravitational attraction on all other particles. As explained in modern physics the gravity of the universe ties all matter of the universe together. The sukta also puts a limit on human intelligence to fully comprehend the process of creation (RigVeda, 10/129/6, 7).

## Manusmriti and Vedic Cosmology Principle

Hindus consider Manu's Manusmriti as one of the oldest books after the Vedas. King Manu and his Manusmriti have been extensively referred to in this book, particularly in Chapter 3 under "India – The Aryavart According to Manu" to establish the historicity of Vedic references used in this book and under "Detailed Time Division of 4.32 BY" in Chapter 5, when large *yuga* periods and the small time unit of *nimesh* were discussed. Although the bulk of the book of this 'law giver king' of the ancient Aryavart is devoted to the code for establishing order in various realms of society by providing rules and regulations in the areas of justice, commerce,

character, division of labor and so on, the *shloka*-couplets in the beginning of Manusmriti's first chapter are devoted to the creation principle of the universe. The first chapter begins with the principle of physical cosmology delineating the beginning of the universe, leading to the rest of the creation on the Earth, including the *dharma* (duty) of a human-being towards the creation on the Earth and the protection of the society. It was therefore deemed necessary to substantiate the Vedic Cosmology Principle in three *Bhavavrittam suktas* of RigVeda by invoking Manu's formulations in his Manusmriti.

It was mentioned earlier that Manusmriti is a compilation of Manu's dispensation of thought to scholarly *rishis* and sages who visited him for an intellectual discourse on the deep subject of *dharma*. Manu began the session with the subject of the creation of the universe from its primordial state to its present functioning diversity in living beings. It becomes quite clear from his description of the cosmological aspect of creation that the *Bhavavrittam sukta* 129 of RigVeda was on his mind. Manu has used Sanskrit vocabulary of his own, independent of the *Bhavavrittam sukta* of RigVeda, yet his thoughts seem to be structured directly on the foundation of this *sukta*. This is no surprise because Manu, throughout his Manusmriti, has referred to the Vedas and emphasized the wisdom of the *rishis*. The merit in Manu's depiction of the subject of cosmology lies in the fact that he has presented some of the abstract thoughts of the Veda mantras in simpler Sanskrit language. Therefore this author felt that Manu's contribution to the subject of cosmology is of great significance and the present text can be enriched by the inclusion of a limited number of Manu's *shlokas*.

Manu has devoted 50 *shlokas* (metered poetic couplets) for the subject of the creation of the universe. These formed a complete set for the benefit of the scholarly people in conference with Manu before he moved on to other subjects that constitute *dharma*. Just as a human being's *dharma* is to follow governing rules and principles about personal responsibilities and duty for which he/she has come into existence, God's *dharma* is to create the universe in which living-beings take birth and do karma with free-will. The *dharma* of the inert Nature, the entire matter of the universe, is to follow the rules under the Creator's *ritam* and *satyam*. All created substances follow their own *dharma* right through the creation. For example the Sun's *dharma* is to continue giving light and sustain the solar system.

The *dharma* of the Earth is to support life on it along with its numerous other functions. Therefore Manu began his lecture to the visiting sages on the subject of cosmology which is an exposé on the *dharma* of the Creator and the *dharma* of Prakriti (Nature) in partnership. All *shlokas* of Manusmriti are in *trishtup* meter with a total of 32 alphabets in all the words used, each line of the couplet having 16 alphabets.

To add to what has been discussed under *Bhavavrittam*, only a few s*hlokas* from Manusmriti are included here. For the brevity of the text the direct translation of the *shloka* is presented without the detailed word-for-word meanings as furnished for the Veda mantras cited earlier.

After a few introductory *shlokas* the fifth *shloka* of Manusmriti is the first on the subject at hand.

आसीदिदं तमोभूतमप्रज्ञातमलक्षणम्[1] ।
अप्रतर्क्यमविज्ञेयं प्रसुप्तमिव[2] सर्वत: ॥

(Manusmriti, 1/5)

**Transliteration:**

**"***Aaseedidam tamobhootam-apragjyaatam-**alakshanam**[1] /Apratarkyam-avigjeyam prasupthmiva*[2] *sarvtah*[3] *//"*

**Shloka Translation**

*"This entire universe before the creation was covered with darkness. At that time it was nondescript, unknowable, not a subject of logic and was without known indicators and properties conceivable by the senses. As if in its entirety it was in deep slumber everywhere"*. (Manusmriti, 1/5)

A direct consequence of this *shloka* is that the universe is created not 'out of nothing'. Manu reflecting on RigVeda mantras (10/129/1, 2, 3) corroborates that the universe did have its presence before creation in an

indefinable state of matter without being a subject of logic. Manusmriti's pre-creation universe is also devoid of radiation everywhere. During that state of the universe, the Veda's non-existence of *praketam* (defining symbols of creation) is Manusmriti's state of *alakshnam*[1], conveying the same meaning. However, Manu used an interesting adjective of *prasuptha-miva* to describe the state of the primordial universe before creation. The conjugate term *prasuptha*-miva[2] means – "*like in a deep sleepy state*". The last term of the *shloka*, *sarvtah*[3] emphasizes that such was the condition '*everywhere*' in the primordial universe – leading to the thought that the starting universe was neither confined in a dimensionless point, as in a modern Big Bang singularity, nor did it originate out of 'nothing'; it started with preexisting inactive matter. Manu used several other adjectives in this *shloka* to describe the '*indefinable*' state of matter. The other points delineating the state of the matter of the universe are straightforward.

As if keeping an eye on the *Bhavavrittam sukta* of RigVeda, Manu preached to the visiting scholars on the 'prime-cause' and the 'material-cause' of creation -

ततः स्वयम्भूर्भगवानव्यक्तो[1] व्यञ्जयन्निदम् ।
महाभूतादिवृत्तौजाः प्रादुरासीत्तमोनुदः ॥(Manusmriti, 1/6)

**Transliteration:**

*Tatah* ***svayambhuh****-bhagvaan-avyakto*[1] *vyanjayannidam| **Maha-bhootaadi**-vritaujaah praaduraaseettamonudah ||*)

**Shloka Translation:**

*"The* ***Svayambhu*** (स्वयम्भू) *Creator, inspired the indefinable* (अव्यक्तो[1] = *avyakto*[1]) *dark state of* matter *into the active state of observable form of creation and while bringing into creation the set of specific* ***maha-bhootas*** (महाभूतादि), ***revealed*** (प्रादुरासीत् = *praaduraaseet*) *Himself through this creation"*. (Manusmriti, 1/6).

The 'prime-cause' of creation according to this *shloka* is the Creator who is also addressed here by the word ***Svayambhu.*** The Sanskrit root of the word *svayambhu* yields – '*one who is unto himself and is not born out of anyone or anything'*. It also means '*the one who is completely self-sufficient in all abilities'*. Implied in the term *svayambhu* is that the Creator

of the universe is an eternal, independent entity, possessing the ability to do work without external help. This also means that there is an Omnipotent and Omniscient Conscious-being with creation energy that inspires the pre-existing indefinable (अव्यक्तो[1] = *avyakto*[1]) 'material-cause', the Nature (matter), to create the universe of definable ***maha-bhootas***. The *shloka* also makes it obvious that the 'material-cause' is different from the Creator.

The word ***bhoota*** in general stands for matter. The term was briefly discussed in Chapter 1 under the sub-title – "Aristotle's Philosophy versus Vedic Philosophy". The term *bhoota* is also used as a noun for specific material entities. For example the Earth is a specific *bhoota* with specific properties providing sustenance for the living creation and so on. The word *bhoota* in the *shloka* appears in plural and appears in conjunction with the word *aadi* for 'several of the set', specifically stressing that these *bhootas* are brought into existence in Nature as the creation begins. Additionally the prefix *maha* in the word ***maha-bhootas*** means the 'great' or the important entities of inert matter. In this *shloka* Manu has just given a hint about the first set of entities of creation and has stressed that matter in the creation phase transits from the indefinable state to a definable state. The definable state of matter tends towards five classes. The specific *bhootas* are named in the *shlokas* that have direct correlation to the five knowledge senses of the living-beings.

The underlying theme of this *shloka* is the matter manifestation in matter's discernible and measurable state, in its five states and the revelation of the Creator by virtue of matter manifestation. If one says that there is matter in the vacuum of a given space, the statement would be meaningless till some matter manifests in that space. According to the Vedic philosophy one cannot create something out of nothing, the 'cause' for the manifested matter has to be matter, even if it is in an un-manifested state. There must be a reason for the un-manifested matter to develop an initiative to manifest. Therefore it comes down to a cause giving the first trigger to matter for its manifestation and therefore the 'first-cause' initiates the matter manifestation.

Now let us replace the vacuum of the given space in our example with the Space-entity and the un-manifested matter with the *Asata*-state of matter that Manu in his *shloka* (Manusmriti, 1/5) has labeled with several adjectives such as:

*"….nondescript, unknowable, not a subject of logic and was without known indicators and properties conceivable by the senses..."*.

Nature is an inert entity without initiative of its own, the 'first-cause' (efficient-cause) providing the trigger for the *Asata*-state to manifest into the *Sata*-state of the tangible universe of ***maha-bhootas*** is the Creation Energy (synonymous with the Creator). Only when the matter of the universe becomes definable and observable can one realize that it was in existence from before creation. It is revealed only when the creation of the universe takes place and the beacons and defining symbols of creation become obvious. The revelation of the well-crafted universe without chaos itself is the revelation of the force behind it, the force being the 'first-cause', the Creator.

In the example of the sculpture and the sculptor, the rough chunk of stone does not reveal either a future sculpture or the sculptor; however, when the stone is sculpted into a spectacular sculpture it reveals the *eekshana* power (visualization, thought and desire) of the sculptor that transformed the rough stone into a meaningful sculpture. The well-crafted sculpture itself reveals that there is a hand of a sculptor (prime-cause) behind the well-defined sculpture. For this revelation, it is not necessary for the sculptor to be present and be observable near the sculpture. Just as the sculpture is a reality its craftsman is also a reality. This is the meaning of the expression in Manu's *shloka* that - –"*The* ***Svayambhu*** (स्वयम्भू) *Creator…**revealed*** (प्रादुरासीत् = *praaduraaseet*) *Himself through this creation"*. The revelation of the Creator does not imply that the Creator takes a particular shape to reveal Himself. Throughout the Vedas and the Vedic Literature (barring the present Hindu mythology and form-worship), the Creator is considered to be all-pervading in the universe and beyond it, a condition fulfilled by a formless entity. The implication of the mantra therefore is that the vastness of creation itself is the revelation of the Creator.

In the *shloka* that follows, Manu talks about the entities of creation that are the early byproducts of Nature, minute enough to defy physical detection by physical instruments made of matter.

उद् बबर्हाऽऽत्मनश्चैव मन: सदसदात्मकम् ।
मनसश्चाप्यहंकारमभिमंतारमीश्वरम् ॥

(Manusmriti, 1/14)

**Transliteration:**

"*Ud babarha- a- aat*m*anashchaiva* ***manah*** *sadsadaatmkam |*
*anasashchaapyam-****ahankaaram****-abhimantaaram-****Ishvaram*** ॥"

**Shloka Translation:**

> *"And then the* ***Ishvara*** *(God with infinite wealth of knowledge) with His self-will created and revealed the* ***Munn****-entity possessing the virtue of sustaining its own causal-state and the ability to interact with the effective state of matter. Also from His* ***Munn*** *He created the* ***ahankaar****-entity that generates the nature of 'I am'".* (Manusmriti, 1/14).

Manu's 14th *shloka* basically refers to the 4th mantra of the *Bhavavrittam* of RigVeda (10/129/4) where the Creator seeds the creation with His *Munn*, resulting in an all-pervading physical entity called the *mahata*-entity that appears as the 'intellect-entity' in living beings. The *Munn*-entity (in Manusmriti) out of which the *ahankaar*-entity originates, is interpreted to be the physical energy field of the *mahata*-entity mentioned as the second entity in the sequence of 25 in Rishi Kapil's creation *sutra* (1/26) in his Saankhya Darshan. The first act of the physical creation is the *mahata*-entity, the force of intellect at an extremely subtle level (metaphysical level) that would form a link between the working matter (the body of the living-being) and its spiritual-self after the living creation begins in the Creation.

The *Munn*-entity that we discussed above as the *Eekshana* of the Creator yielding the *mahata*-entity, which rises in the creation as the first link between matter and the spiritual-self, is therefore an inherent property available from the universe. The *mahata*-entity of the Vedas and Manusmriti is the minutest among the physical entities created out of matter and therefore is in the form of an all-pervading energy field accessible by all living beings wherever they take birth in the universe.

The *mahata*-entity (intellect force) once created as the first ingredient of Nature, subsequently serves as the cause for the next entity termed as the *ahankaar*-entity, which in the ordinary sense, appears as the ego in living matter. While *ahankaar* is present in all living units and is a necessity for their individual survival, it appears in human beings as the feeling of 'I am'. This is being pointed out in Manu's *shloka*. In a Vedic principle, "The 'e*ffect' is the next degenerate state of its 'cause'*". The Vedic creation sequence begins from the finest state of matter and progresses towards the coarser state of matter. The coarse state of matter is the degenerate state of the fine state. Therefore, the *ahankaar*-entity is the coarse state of the finer state of the *mahata*-entity. The *mahata*-entity and the *ahankaar*-entity could be viewed as two different all-pervading energy-fields such that the coarser of the two, the *ahankaar*-entity becomes the 'cause' for the coarser states of matter that are to follow in the creation. It is generalized in the Vedic cosmology that the 'cause' of all subsequent forms of matter is the *ahankaar*-entity. Manusmriti's *mahata*-entity and *ahankaar*-entity are the first two of the seven *devas* that were mentioned under the RigVeda mantra (10/129/6) which function through the living-beings. With regard to these two energy fields, a primary difference between the Vedic and modern cosmology is that the latter begins after these two energy fields, *mahata* and *ahankaar*, are already in place, pervading through the early universe.

महांतमेव चाऽऽत्मानं सर्वाणि त्रिगुणानि1 च ।
विषयाणां गृहीतृणि शनै: पञ्चेन्द्रियाणि च ॥

(Manusmriti, 1/15)

**Transliteration:**

Mahaantmeva cha-aatmaanam sarvaani trigunaani cha ।Vishayaanaam griheetrini shanaih panchendriyaani cha ॥"

**Shloka Translation:**

*"For the benefit of the soul, the sequence of creation creates from the mahata-entity all forms of tri-property matter. Out of the tri-property matter appear the five specific categories of matter which are the subject of five knowledge-senses* (in living beings)." (Manusmriti, 1/15).

Manusmriti's त्रिगुणानि[1] (*tri-gunaani*) is the tri-property matter that was discussed in Chapter 5 based on the Vedic definition of three properties named *sata, raja* and *tama*. Recall that these three properties in matter are thought to create fundamental particles of matter in differing proportions to cause diversity in matter. A simile was also drawn by this author to suggest that these three properties are in the likeness of three quarks forming the nucleus of the smallest atom. Implicit in Manu's *shloka* is that matter at its fundamental level is in tri-property and that it ultimately precipitates into the five *maha-bhootas* (major categories of matter). These five categories of matter are for the benefit of the soul because they are the subjects of the five knowledge senses in living beings. Since the knowledge senses are sheltered only in a living physical body, the net knowledge benefit to a soul through the five senses is when the soul is in a living body. The only way the knowledge of the universe can reach the soul is when the soul's physical body is equipped first with the five knowledge senses. This knowledge comes in small steps when the five knowledge senses independently interact with five different realms of the created matter. The biochemical functions at a metaphysical level within the living-being receive information from the five senses and process it. The information is transformed into knowledge for the indwelling consciousness and may also be transformed into instructions for different limbs of the physical body. It is well discussed in modern science how a living being develops cognitive ability. In Vedic thought the cognitive functions, *mahata* and *ahankaara* (intellect and ego), are available to the quantum of consciousness (soul) as all-pervading energy-fields from which to extract these metaphysical energy fields according to its ability, when forming its connection to a physical body.

The emphasis in Manu's *shloka* is that for the soul to benefit from the creation, it has to have the ability to interact with the matter of the universe. To establish this interaction, the minute soul has to have at its disposal the subtle and suitable forms of matter and energies so that it can carry out

action (karma) with free-will. The five *maha-bhootas* (five categories of matter/energies), the five knowledge implements (senses) and the subtle forces, *mahata* (Intellect-element) and *ahankaar* (Ego-element) provide the needed ability to the soul. In the Vedic thought and therefore for Manu, the creation of the vast universe with the great cosmos in it is meaningless if the role of the soul (consciousness) is not an integral part of it.

The discussion on the most subtle fields such as *mahata*, *ahankaar*, *munn* (Mind) five *tanmaatras*, five *maha-bhootas* and the related five knowledge-senses and their interaction with matter through the living-matter is deferred to another text.

**Deductions from Manusmriti shlokas**

- (26) The pre-creation state of Nature in the Vedic cosmology is in an indefinable slumberous state devoid of radiation field and dynamics (Manusmriti, 1/5).

- (27) The five knowledge-senses in living beings are the 'effect' of the five causal states of matter that lead to five categories of matter-creation in the universe (Manusmriti, 1/6).

- (28) The 'causal-state' of matter is subtler than the resulting coarser state of matter - is a Vedic creation principle emphasized in Manusmriti (Manusmriti, 1/5, 6, 14, 16)

# Salient Conclusions from Chapter 6

Twenty-eight deductions based on the Veda mantras and Manusmriti *shlokas* are drawn in this chapter. These deductions form the basis for the Vedic Cosmology Principle and for developing the Vedic Big Bang Scenario for the advent of the universe in Chapters 7, 8 and 9. The author of this book however does not claim that this list of deductions is exhaustive and complete. The effort in this chapter and in the entire book for that matter is based on the best understanding of the Vedic mantras and the hidden thought in them. This Vedic Cosmology Principle could be enriched further by adding more mantras.

**This picture of the universe drawn from these deductions will certainly tickle the imagination of many readers to wonder about the ancient wisdom and to broaden the cosmology perspective to include other possibilities along with the modern Big Bang Hypothesis.**

Beginning with the title "*Bhavavrittam*" of the *sukta*, which means the **History of Creation of the Universe**, the terminology in the mantras is amazingly apposite to cosmology. The title itself reveals that the subject matter of the mantras is cosmogony. The mantras differentiate between the states of matter, the initial confinement of Nature in a small space (*tuchchhaya*) which upon receiving the extrinsic trigger of *Eekshana* energy creates heat energy and transits from *Asata*-state of matter to the *Sata-state*.

The developed heat energy causes the Vedic Big Bang with omni-directional (*tirashcheenh*) instantaneous-expansion (*vitatah*) of matter, leading to the creation of great cosmos (*mahimaanah*) from fundamental minute seeds of matter (*retodha*).

The mantras depict a picture of the universe from its initial non-radiative, dark, gravid (*tamah sa*) primordial fog (*kuhakasya*), without exhibiting at that time any defining symbols (*apraketam*) of the universe. From that state of primordial Nature emerges the resplendent creation (*vi-srishti*) spread out in the vast Space (*Vyom*). All this is expressed in the richness of the Vedic terminology in cosmology. The statements and details contained in the Vedic mantras, presented above on Vedic Cosmology Principle, cannot be construed as mere imaginations and dreams of the Vedic sages.

The amazing terminology, thought-form, beautiful inimitable metered poetry, depth of logic and expression of ideas in compact mantra

formulation, all reflect an organized and disciplined pool of knowledge that must have pre-existed the Vedic sage. It must have pre-existed either in the physical realm of the present universe, through the knowledge dissemination between humans in a highly developed social structure, or as the agglomeration in the individual sage's spiritual ledger.

A mantra is a reality and the knowledge content in it is a reality too. Then it is not congruous to say that the knowledge content of the mantra was fortuitous. If a science-thought was the result of the thought in a mantra, the least one must do before discarding it is to explain on a scientific basis why a sage would reach a conclusion that was as scientific then as it is now.

From what is presented above and throughout this book, the scholarly would find that the Vedic formulations in the mantras are at an intellectual level capable of forming an able partnership with scientific discussions and deductions by physicists of today. The fact is that the complex issues in modern cosmology remain outstanding and therefore it is still not a final principle. It is remarkable that in ancient times the *rishis* laid down formulations, on a qualitative basis, that exhibit all-encompassing thinking on complex issues of cosmology. The Vedic cosmology certainly provides alternate thinking in cosmology and philosophy.

# CHAPTER 7: The Energy Forms in the Vedic Big Bang Scenario

When the story-teller cosmologist said that the universe was created out of a big explosion in a dimensionless "space-time singularity" and its fragments formed the brilliant stars and the stars together formed the well-shaped galaxies that are still flying away from each other, the listener expressed doubt about a dimensionless point in space creating anything. But the story-teller emphasized – yes the entire universe, weighing $10^{60}$ kg "came out of nothing" with a bang and was right away subjected to the Cosmic Inflation to expand it at an accelerated rate. When the listener asked how fast the acceleration was, the cosmologist quickly divided the change in the size of the universe with the duration of the Cosmic Inflation and said – about $3.33 \times 10^{21}$ times the speed of light. However, another story-teller had told the listener that nothing should travel faster than light let alone trillion-billion times the speed of light. So, he wondered if he was listening to 'science fiction'.

The Vedic cosmologist on the other hand tells his own version of the story of creation of the universe; the Veda mantras reveal that all ingredients, entities and functions are real and natural. The entire matter of the universe, right to its last particle, is first inactive, non-reactive and in the indefinable *Asata*-state in the form of an ovate (spheroid) confined in *tuchchhaya* (diminutive) volume. A spark of energy from the all-pervading energy field energizes this matter conglomerate, switching its *Asata*-state to *Sata*-state of definable real matter, right to its last particle (all matter conserved). It develops heat energy and swells. The mantras stipulate (RigVeda, 10/72/9; Shatpath Brahmana, 11/1/6/1, 2; …) that the matter conglomerate remains in an incubation period of one *deva-yuga* of 4.32 million years. During this period it develops tremendous heat energy (*tapah*), immense spin and remains in *paryaplav* rotation (rotation in floatation) around an axis. Owing to its brilliant appearance due to the high

heat energy in it the Veda addresses it with several befitting names, explained later. After building enough heat energy and rotational momentum over a period of 4.32 million years the brilliantly hot primordial ovate of matter explodes into uncountable ovates filling the empty space to far distances (RigVeda, 10/72/9 and other references).

The eons old Vedic story of cosmology has no known framework of complex physics and mathematics, yet it delineates the definite steps that the primordial matter took under realistic physics and mechanics, leaving the reader wondering why many features of the Vedic Big Bang stipulated in the Vedas eons ago are similar to those in the modern Big Bang Hypothesis.

This author in his study of the Veda mantras discovered that in the processes of formation and dissolution of the universe, several energy forms are in play. Whereas the most obvious energy forms are of physical nature to manouvere matter, the *Eekshana* energy with consciousness as its source, discussed in Chapter 6, also plays its own role. Since the matter-matter transition in the Vedic Cosmology has a meaning different from the one in modern Big Bang Hypothesis the author has introduced and defined several new terms such as the **'**Latent Kinetic Energy' and the 'True Absolute Zero Temperature.

# Terms and Definitions in Vedic Creation Scenario

Keeping in perspective the definitions and functions of the Vedic entities discussed in Chapter 5 and the cosmological principles and processes stated in the mantra formulations, elaborated upon in Chapter 6, a qualitative scenario for the creation of the universe is developed from its very beginning in *srishti* to the present state and to its end in *pralay*. This is laid out in several sequential steps which represent different phases of the advent of the universe, even though some of the steps are simultaneous. Each step is an outcome gleaned from the mantras that have been discussed in the Vedic Cosmology Principle developed in Chapter 6 and also the mantras that are invoked for the first time in this chapter and forthcoming chapters.

The universe is the transition of matter from the *Asata*-state into the *Sata*-state. The *Sata*-state of matter in the created universe is in two basic forms, the substantive matter with mass and the non-substantive matter in energy form without mass. All forms are said to be matter and all matter of the universe is Nature (*Prakriti*). The most fundamental building block of Nature (matter/energy) is the Vedic triplet named *aapah* – the three components of it with differing properties and nature being *satah, rajah* and *tamah*. The differing proportions of *satah, rajah* and *tamah* quanta lead to the formation of matter throughout the universe in all its diversity in both phases- substantive and non-substantive. According to the Vedic physics, even a quantum of energy the photon of light is not a solo particle; it is made up of *aapah* particles with dominant *rajah* component. The specifics of these proportions of the tri-property *aapah* are not available to this author from the present Vedic Literature, the literature that has survived the onslaught of time.

# Energy Forms in Vedic Cosmology

Energy is needed to change one state of matter into another. This was stated eons ago in the same way as modern physics states it now. Also, the Vedic thinkers stated that one form of energy can be converted into another form of energy. In modern cosmology when the context is the creation process of the universe and the estimates of matter and energy are required, one resorts to physics and mathematics to generate realistic numbers. In the qualitative Vedic creation process presented here the relevant mantras may not provide quantitative values of matter and energy; they at times implicitly express the state and form of matter and energy. However, any mantra from the far antiquity conveying physics knowledge is to be recognized by a modern physicist as such and treated as a gift from a *rishi*. As an example, Rishi Yask in his ancient Nirukt Sutra (5/1/3/1) cites a thermal physicist Sthaulashttheevi (स्थौलाश्ठीवी) who stated that the *Agni* (energy) has the property of *aknopan* (अक्नोपन), meaning - '*Agni creates separation in substances*'. The *Agni* (energy) here obviously is the 'thermal energy'.

Since different energy forms will be referred to in this creation scenario, the author has named them in a terminology commensurate with modern physics, denoting them with the symbol **E**. They are: $\mathbf{E_{e\text{-}m}}$ (*eekshana-munn* energy), $\mathbf{E_h}$ (heat/radiational energy), $\mathbf{E_k}$ (kinetic), $\mathbf{E_r}$ (rotational), $\mathbf{E_p}$ (potential), $\mathbf{E_b}$ (molecular bond energy). Corresponding to the kinetic energy $\mathbf{E_k}$ is the object's momentum, which is the product of the mass and the velocity of the object. With the exception of the *eekshana-munn* energy $\mathbf{E_{e\text{-}m}}$, the other energy forms in the Vedic scenario are the same as in modern physics. A short discussion on primary energy forms is presented here.

## Omnipresent *Eekshana-*

## *Munn* Energy Field $E_{e\text{-}m}$

In the Vedic Big Bang an all-pervading energy-field of a different nature exists owing to the all-pervading presence of the *Purush*-entity defined and discussed under the sub-heading – "The Creator-Entity (*Purush-tatva*)" in Chapter 5. The Vedas being theistic the all-pervading, unitary conterminous Consciousness of the first-kind serves as the 'efficient-cause' for the creation of the universe; the second kind of consciousness being the quantized field of consciousness, the souls. It is difficult to visualize an all-pervading conterminous entity such as the consciousness of the first kind defined in Chapter 5. The localized presence of the consciousness of the second kind, also defined in Chapter 5, could be visualized as a living-being with a physical body having a limited area of influence. A non-substantive thought even in the mind (*munn*) of a consciousness of the second-kind (e.g. human-being) affects matter within its limited area of influence. The thought triggers biochemical reaction in his material body resulting into mechanical action by the limbs. Thus a thought is the cause for the physical form of energy - mechanical or heat, when the conscious-being applies his desire (*eekshana*) to implement the newly created energy. The equation of this process is 'mind (*munn*)-over-matter'. The area of influence of the Consciousness of the first-kind (the Creator-entity) according to the Vedas is not only the entire universe but it pervades through each matter particle of the universe.

Vedas often use interesting metaphors to explain complex phenomenon, the metaphor pertaining to the entire universe is: "*the entire universe is the body of the Creator-entity*". This implies that just as in a human body a thought affects its cells the Creator's *Eekshana-Munn* energy ($\mathbf{E_{e\text{-}m}}$) affects each fundamental particle of the universe. The effect of this creation energy is to generate all properties in the material-cause of the universe (Nature) that are discerned in the created universe and it generates the physical form of heat energy $\mathbf{E_h}$ in the matter of the universe. The Vedic definition of *eekshana* (desire) force, discussed under "Eekshana Force" in Chapter 5, being – "*The power of the mind with the combination of three factors; visualization, thought and desire, by which a conscious-being is able to create tangible things"*, the tangible universe is initiated and created as a well thought through experiment in *Prakriti* (Nature) by the Creator-entity. The consciousness energy $\mathbf{E_{e\text{-}m}}$ originating from the Creator energy field and the physical form of energy $\mathbf{E_h}$ originating from the matter (Nature) together initiate the formation of the universe.

The energy $\mathbf{E_{e\text{-}m}}$ is not one of the physical forms of energies that are measured with instruments made of matter and observed through the effects that they create in the universe. It is an all-pervading energy of spiritual nature. In both phases of the creation, *kalp* and *vikalp*, the matter of the universe is embedded in this energy-field of the omnipresent, all-permeating, unitary conscious spirit of *Brahmn*. The all-permeating *Brahmn* energy is considered by the Vedas to be the prime Creator of the universe, making the Vedic creation principle theistic. It is theistic with a difference. The physical process of the creation of the universe in Vedic Cosmology is quite detailed and elucidated in the terminology quite close to the one employed in modern physics and cosmology. This all-pervading energy field is one of the five eternal entities of the Vedic philosophy defined and discussed in Chapter 5.

Based on the RigVeda mantra (10/129/2) a step in the creation of the universe was assigned in the Vedic Cosmology Principle developed in Chapter 6 (deduction 6). The second part of the mantra in physics terminology stated -

> *"… In addition to Nature (Svadha) there existed an all-pervading energy field unaffected by physical forces and processes. Entire matter of the universe was embedded in Brahmn and the Brahmn extended beyond the universe and nothing extended beyond Brahmn*". (RigVeda, 10/129/2).

This unique, all-pervading energy-field, *unaffected by physical forces and processes*, is not viable in the modern cosmology's perspective. At the same time it would be imprecise to surmise that the modern cosmology/physics has discovered all fields and forces of the universe. Therefore the existence of a force, with all-permeating consciousness as its additional virtue, remains a possibility. There is however another force-field of a physical nature in the universe that overall is also unaffected by physical forces and processes. It is the well-known all-pervading universal gravitational force due to the mass of the entire universe. The Sun owing to its own enormous mass has gravitational field reaching out over large distances. It penetrates and gravitationally influences all individual atoms and molecules of the colossal Earth and beyond. This gravitational field is inseparably embedded in the universe's overall gravitational field. For a

cosmologist to consider the possibility of $\mathbf{E_{e\text{-}m}}$ means exploration in theism; however, some other energy field, of a different source, not discovered yet, in which the entire universe is embedded should always be an intriguing possibility. As stipulated in Chapter 2, '*the immeasurability is not a proof of the absence of a phenomenon*'; a real spiritual component could exist in the universe and go undetected by physical means. If in the Big Bang Hypothesis an immeasurable, non-harnessable and all-pervading Dark Energy could exist, with the mechanism of its creation unknown, the existence of $\mathbf{E_{e\text{-}m}}$ is a possibility.

For a moment let us go back to the example of the conscious-being pot-maker. It is easy to observe the pot-maker's mechanical action of kneading and pounding the clay using his own physical energy that he generates in his body. But this is only an observed secondary effect. The primary unobservable action is the conscious-being pot-maker's ईक्षण (*eekshana*-desire) with its operators being "*visualization, thought* and *desire"*, to create a tangible object, the pot in this example. So, in the first place it is the unobservable *eekshana* that gives rise to the observable mechanical energetic action of pounding the clay, rotating the stone-flywheel and molding the clay. The unobservable *eekshana* is as real a phenomenon in the conscious-being pot-maker, as the observable mechanical action to generate physical energy.

The Vedic philosophy prescribes 13 *karans* (doers) in a conscious-being that together help the consciousness to acquire knowledge. They are: 3 internal functions, the *buddhi* (intellect), *ahankaar* (ego) and *munn* (mind) and 10 outer functions including the 5 knowledge-senses and 5 action-functions. They are the subject of another book; here it would suffice to say that the force of the *eekshana*-desire of the conscious-being generates thought in the brain and directs its *munn*-function (mind) to create a definite change in the chemistry of its own physical body. Then the *munn* energizes all necessary knowledge senses and functions leading to the physical transformation in its own physical body as well as in the immediate surrounding space. The net result is the generation of the physical energy leading to an observable mechanical action by the physical body of the conscious-being. All this takes place following the law of conservation of energy.

Therefore, if a mechanical action is observed being created by a conscious-being, it is at the cost of some energy generated within that

conscious-being. The only energy that generates a mechanical action in a living body is owing to the thought process of the living-being. The desire is the person's *eekshana* that generates the action in its *munn*-function (mind). Without invoking modern developments in neuro-science to explain the steps as to how a thought creates the spurts of energy in the physical body that a conscious-being can put to use, one can observe that a conscious-being, in a limited sphere of influence, creates energy from a thought that he produces in his own brain. In the Vedic terminology – the formless *eekshana* of the formless conscious-being-soul in the living body with form generates from the formless thought the physical energy (heat); all ingredients to create this energy are drawn from the conscious-being's body. An interesting observation about the thought producing machine (the brain) is that it does not indicate depletion in the thought reservoir (if there is one) and it does not show signs of getting physically tired, rather it gives the impression that it carries unlimited thought energy.

Now this discussion, pertaining to a conscious-being operating in a limited space, is to be applied to the all-pervading conscious-being-Creator with His body being the immeasurably big universe and beyond.

Recalling the discussion on RigVeda (10/129/4) and Manusmriti (1/6) from Chapter 6, it is the Creator's spiritual energy (thought) $\mathbf{E_{e\text{-}m}}$ arising out of His काम: (*kaamh*) the ईक्षण (*Eekshana*/desire), in the form of His *Munn*-entity (mind), which reverses the nature of the inactive *Asata*-state of the dissolved matter-phase into the active *Sata*-state under the preset *ritam* and *satyam* rules of creation (discussed in Chapter 5). This action establishes the Creator's mind-over-matter. In the case of a human-being the area of influence of his mind-over-matter is limited primarily to his physical body in which he creates the bio-chemical change to generate energy for an action. To affect the matter outside his body with the energy that he generates, he ends up using his limbs and instruments; but still in a limited area of influence. The Creator on the other hand being the all-pervading energy-field throughout the universe and beyond and through the core of each fundamental particle of the universe has His area of influence at each and every point of the universe. Therefore with the Creator's mind-over-matter, with *Eekshana-Munn* energy $\mathbf{E_{e\text{-}m}}$, the Creator leads all matter in the *Asata*-state to blossom into the divergent, dynamic *Sata*-state.

When the Nature is in *sushupti* (sleepy) state in its *pralaya* (dissolution) phase, the matter of the Nature is devoid of any energy. On

receiving $\mathbf{E_{e\text{-}m}}$ each fundamental corpuscle of matter is energized (awakened) to become physically active *retah* (रेत:), and all physical properties of matter are revealed - the mass, charge, motion and all those properties and laws of Nature that are needed to create a perfect universe, which can also sustain life. These physical properties are in turn responsible for creating new forms of matter and energy from the preexisting matter and energy. The credit for transforming all matter and energy is given to the universe-initiating energy $\mathbf{E_{e\text{-}m}}$. This means that if the heat energy is developed in the primordial matter of the universe owing to the gravitational property in matter, a Vedic expression for it could be "*The Brahmn infused the* तपस: (*tapasah*) the *heat form of energy into the Hiranya-garbh (Golden-embryo) of Nature*" (e.g in RigVeda, 10/129/3).

## तपस: (*tapasah*) the Heat Energy $\mathbf{E_h}$

The familiar and measurable physical energy is the heat energy $\mathbf{E_h}$, the तपस: (*tapasah*) mentioned in the context of the creation of the universe in a number of mantras in the four Vedas including the RigVeda mantras (10/129/3, 10/190/1) from which the deductions 9 and 23 are drawn in Chapter 6 of this book. For the universe to reach an orderly state the application of all energies and forces are to be governed by the laws under *ritam* and *satyam* discussed under the RigVeda mantra (10/190/1) and the deduction 22 in Chapter 6; *satyam* encompasses the physical laws governing the physical universe. The *satyam* laws are discoverable under physics.

A modern cosmologist deals with the inert Nature as the prime subject of creation. But the condition imposed on this prime subject is that it has heat energy $\mathbf{E_h}$ in it at temperatures higher than $10^{32}$ ºK and it is a dimensionless "space-time singularity". However, the chicken-first-egg-first dilemma muddles the first moment of creation. The dilemma is that the matter is temperature's shelter and the temperature of matter rises or falls owing to an underlying dynamic process. This means that if the temperature existed in the space-time singularity the matter was already there. Then what initiated the first moment or the moment prior to it for the matter to appear and the temperature to rise? This dilemma is ignored by the modern cosmology but a theist cosmologist of the Veda resolves it by stating that

having no underlying process in the inert Nature in its indefinable *Asata*-state there is no rise in temperature and the Nature is at "True Absolute Zero °K". An extrinsic trigger in the *Asata*-state from the metaphysical omnipresent *Eekshana-Munn* energy $\mathbf{E_{e\text{-}m}}$ of the Creator initiates the creation. The $\mathbf{E_h}$ in modern cosmology is part of the energy-matter equation in the Big Bang singularity wherein the strength of $\mathbf{E_h}$ is represented by the degrees of temperature. In the Vedic perspective however, even if the $\mathbf{E_h}$ is developed within the primordial mass of matter due to physical processes the $\mathbf{E_{e\text{-}m}}$ is said to be the cause and $\mathbf{E_h}$ its effect. An apparent contradiction in the modern Big Bang is that if matter is the shelter for energy or its representative temperature, the Big Bang singularity was the only thing that existed before the universe was initiated in it and the definition of the singularity is that it has neither Space nor Time or matter in it to shelter $\mathbf{E_h}$, leave alone exhibiting the corresponding temperature. However, the premise of the Big Bang Hypothesis is that the Big Bang begins with infinitely high temperatures in the singularity.

Rishi Kanaad in his Vaisheshik Sutra defines an entity with its '*lingam*' (defining indicator). In the same perspective the temperature could be viewed as the *lingam* of the energy $\mathbf{E_h}$. However, the heat energy being the vibrations in the form of radiation can also exist in vacuum without a shelter. The solar heat for instance travels mostly through the vacuum of space between the Sun and the Earth. But this heat energy does not raise the temperature of the intervening space because the intervening space serves as the medium for the solar energy to travel and does not serve as a shelter for the solar heat. Therefore, in this author's perspective the $\mathbf{E_h}$ is present if its *lingam* (temperature) is observable or measurable. The *lingam* of energy is observable only if it is sheltered by matter.

Nature in its *Asata*-state being at True Absolute Zero Temperature (discussed below) there is no $\mathbf{E_h}$ in it. The $\mathbf{E_h}$ is developed owing to the properties in matter which according to the Vedic Cosmology are initiated due to the infusion of the Creator's $\mathbf{E_{e\text{-}m}}$. Pertaining to temperature, the main difference between the beginnings of the Vedic Creation process and the modern Big Bang is that the former begins at the True Absolute Zero Temperature which in modern physics definition is below Absolute Zero and the latter begins at an extremely high temperature.

## Linear and Rotational Kinetic Energy:

## $E_k$ , $E_r$

What one observes in the observable universe is the resplendent heat energy $\mathbf{E_h}$ whereas the energy $\mathbf{E_{e\text{-}m}}$ of spiritual nature remains latent. An object with linear motion possesses the Linear Kinetic Energy $\mathbf{E_k}$ owing to its mass m and linear velocity v ($mv^2/2$); an example being a car traveling on a straight road. Likewise an object moving in angular (circular) motion possesses Rotational Kinetic Energy $\mathbf{E_r}$ owing to its mass and rotational (angular) velocity (ω); an example being the Earth rotating around the Sun. In the modern Big Bang scenario there is nothing like a rotational energy as a part of the Big Bang initiation. The modern Big Bang is initiated by $\mathbf{E_h}$ which creates a big explosion in the primordial matter within the Big Bang singularity, sending matter linearly outwards in all directions with all the components of the Big Bang acquiring linear kinetic energy $\mathbf{E_k}$.

In the Vedic Big Bang scenario both, the $\mathbf{E_h}$ and $\mathbf{E_r}$ are simultaneously generated by the Creator's initiation energy $\mathbf{E_{e\text{-}m}}$ and are applied to the primordial blob of Nature (matter). The beginning of the Vedic universe is also with a tremendous bang due to a combination of two energies, the heat energy $\mathbf{E_h}$ in the mass of the *Hiranya-aand* (Golden-ovate) and the Rotational Kinetic Energy $\mathbf{E_r}$ owing to the tremendous spin that the primordial matter developed over an incubation period of one *deva-yuga* of 4.32 MY (Shatpath Brahmana, 11/1/6/1, 2) when it was in *paryaplav* rotation (rotation in floatation) around an axis. During this definite period of 4.32 million years (MY) the *Hiranya-aand* built enough heat energy and rotational energy to explode into uncountable ovates sending matter to far distances (RigVeda, 10/72/9). The rotation of the entire matter of the universe in a *paryaplav* is a unique feature of the Vedic cosmology and it is this initial rotational momentum in the matter of the universe that manifests in the rotation of all galaxies and celestial bodies and systems of celestial bodies in the universe. When the matter flies out in this explosion it has

tremendous rotational kinetic energy $\mathbf{E_r}$ as well as the linear kinetic energy $\mathbf{E_k}$.

The consequences of this new concept, the addition of the $\mathbf{E_r}$ in the Vedic Big Bang scenario, are unique and immense. They are discussed further in the text that follows ***Prakriti*** **(Nature) in eternal Space and Time**

The conditions of the universe, immediately before the beginning of creation, are stated in the first mantra- नासदासीन्नो सदासीत्त**…..** (*na-asda-seenno*….), of the *Bhavavrittam sukta* of RigVeda (10-129/1-7) analyzed in Chapter 6. The first part of the mantra states,

> *"Preceding the srishti (created universe), it is not that 'Asata', the indefinable matter was not in existence, it is the 'Sata', the real definable matter that did not come into existence …..."*(RigVeda,10/129/1).

To emphasize again, the matter of the universe has always been there since eternity and only its state changes, the *Sata*-state being the definable state to create the universe. The pre-creation state of matter, the *Asata*-state, is further emphasized in the third mantra of the *Bhavavrittam sukta* as -

> "इदम् सर्वम् (*idam sarvam*), *this entire observable universe;* अग्रे (*agre*), *preceding its existence; was in its causal form (the* ***Salilam****) without any defining symbols of creation…"* (RigVeda, 10/129/3).

The explicit emphasis in the Veda mantra is that the *Asata*-state did have its existence as indefinable matter before the Vedic creation began and that it occupied a तुच्छ्येन (*tuchchhayen* = from diminutive) Space (RigVeda, 10/129/3). These Veda mantras do not give any specific dimensions of the *tuchchhaya* space containing the pre-creation matter of the universe during Nature's *Asata*-state. The adjective *tuchchhaya* could be interpreted to mean 'negligibly small', as in the Big Bang singularity, which in fact by definition goes beyond being 'negligibly small' to a dimensionless point. However, there are all indications in the Vedas that the

Vedic Space-entity in the pre-creation phase does not disappear completely as in a dimensionless space-time singularity of the modern Big Bang Hypothesis. The Vedic principle, for the continued existence of Space in its *kalp* and *vikalp* durations which are its *srishti* (creation) and *pralaya* (dissolution) phases, is also mentioned in a specific statement by Krishn in Bhagvadgita (2/16),

> *The scholars of substances and entities of creation have deducted that what is not, cannot become something and what is something cannot become nothing"* (Bhagvadgita, 2/16).

Krishn, a great yogi with deep Vedic knowledge about the creation of the universe enlightens the listener in his sermon in Bhagvadgita about the nature of the Space-entity (*Antariksh*) and the nature of the Nature-entity (*Prakriti*). In the Vedic thought the substances and entities that are observed in the created universe never had their origin in 'nothingness'. The pre-existing matter transited from one state to another and into the preexisting Space for holding it. The eternal entities of the Veda - Space, Time and Nature (matter), are newly created for the first time in the modern Big Bang Hypothesis (discussed in Chapters 2 and 5). A cosmologist uses Quantum Physics to explain the creation of the universe's matter but is not able to explain what mechanism creates the Space and Time at the same time. This puts Big Bang Hypothesis in the category of a conjecture and it falls under the logical fallacy of अनैकान्तिक न्याय (*Anaikaantic Nyaaya*) where one applies the same logic 'in favour', 'in opposition' and 'on both sides'.

As discussed in Chapter 5, a Vedic cosmologist is free of this fallacy because the Space and Time have no cause of their creation- they are eternal entities. The Space-entity according to the Veda is the container of the matter of the universe, to be available when the universe is created. Not having the Space-entity before the Big Bang defies commonsense because even a farmer milking a cow holds the milk-pot under the cow's udders before beginning the process of milking. In any scenario, modern or ancient, the pre-existence of Space and Time should be a minimum condition, the Space for holding the created matter and the Time for taking the next moment in advancing the age of the universe. The matter in the Vedic Creation Principle being held in *tuchchhaya* (diminutive) Space

during the *Asata*-state is the essential condition requiring the storage of the inactive matter.

The RigVeda mantras (10/130/1-2) state that the Creator-entity stretched the Space-entity for creating the universe. These mantras explicitly state that (a) the Space-entity is stretchable and (b) the matter of the universe is different from the Space-entity. As mentioned before, there is mass-energy equivalence through Einstein's equation, $E = mc^2$, however, with regard to Space and Time the modern cosmology goes as far as coupling the Space-entity with the Time-entity to have the space-time continuum. This however does not suggest that one is being produced out of the other. It is logical to suggest that a coupling of two things is possible when the two things are already in existence. If the Space was created out of matter or out of energy, we would have discovered by now an equivalence relationship between the matter and Space also, which at the moment is non-existent. Thus the Space and Time are two independent entities which could be coupled only in mathematics and not in reality.

If modern cosmology were to suggest that matter was the material-cause of Space, it would find itself in the 'chicken-first-egg-first' predicament because space is needed first for matter to exist in. In a mathematical space-time singularity wherein the matter did not come into existence yet and the Space also was a dimensionless point, the Big Bang process had to create Space first to hold in it the first fundamental particle of matter. But create the Space out of what? The Vedic eternal Space-entity resolves the dilemma. As emphasized in Chapter 5 the Vedic Space-entity neither reacts nor interacts with matter nor is it consumed by matter. It just provides room for matter to exist in. This is a property of Space which is more or less the same in both, the Vedic thought and modern cosmology. These factors impose a necessary condition on Space - that it has to pre-exist for the matter to appear in. Therefore, in Figure 7.1 the universe in its *pralaya*-phase (before time t = 0 seconds of the Big Bang), is symbolically represented by a small sphere A of indefinable matter, the Vedic *Asata*-state of Nature, rather than a dimensionless space-time singularity of the modern Big Bang.

In the dissolution phase of Nature all diversity in matter, including the diversity within each atom (neutrons, protons, electrons) of the universe, collapses, shrinking the matter and the Space with it. This is the message of the Veda mantras as grasped by this author. The matter transition from its

slumberous *Asata*-state into the *Sata*-state of the present dynamic universe could be looked at with the terminology of classical modern physics, as discussed in the following.

# Tuchchhaya (diminutive) versus Colossal Space-entity

Consider the present observable universe. What one is able to observe from and around the Earth is said to be the observable universe which is also called the 'local universe'. The universe beyond the local universe is not seen because the light rays from that part of the universe have not reached the Earth yet. The rate of expansion of the universe, based on the light from the distant galaxies at the observable universe's periphery to the Earth is used by astronomers to estimate the universe's age, about 13.8 BY, with its approximate radius $r_{univ} = 4.4x10^{26}$ meters. How much more universe is beyond the observable universe is anyone's guess and therefore the rhetorical question raised by the RigVeda mantra (10/129/6) - "*who can proclaim with complete certainty on this subject*?" applies.

The specific dimensions of the *tuchchhaya* Space are not revealed in the mantra. This author presents calculations to develop a perspective between *tuchchhaya* and the colossal. The mantra's revelation is that there is no dynamics outside or inside of each fundamental particle of the *Asata*-state of matter. The present colossal universe is spread out thin with lots of empty space between the galaxies and the stars. The following calculations help us to understand how big the universe is going to be if all matter of the universe is brought together into a single compact ball. To do this let us invoke the classical picture of a Hydrogen atom and perform some simple calculations.

**Volume of Observable Universe: ($V_{univ}$)**

The observable universe when observed from the Earth is seen homogeneous in all directions. This means that we are selectively seeing a spherical volume of the universe around the Earth. Let us carry out the desired calculations for the spherical volume of the observable universe.

The present volume of the observable universe is (using radius-volume formula),

$V_{univ} = (4/3)\ \pi\ (r_{univ})^3 = (4/3)$ x $3.14159x(4.4x10^{26})^3 = 3.57x10^{80}$ meter-cube, where $r_{univ}$ is the radius of the observable universe and the Greek

letter π is a universal constant of value 3.14159…, which is the ratio between the circumference of a circle and its diameter.

**Number of Hydrogen Atoms in the universe ($N_{H\text{-}total}$)**

The lower side limit of the mass of the universe is estimated to be approximately $10^{54}$ kg. Of this mass, about 74% is in the smallest atoms, Hydrogen, about 25% is Helium and the rest 1% mass of the universe is in other heavier atoms. Compared to the entire universe, the Sun's mass for example is 71% Hydrogen and 27.1% Helium. Thus the universe is predominantly Hydrogen. Helium being 4 times heavier than Hydrogen the number of Hydrogen atoms are proportionately even more abundant. When one considers the proportion of the number of atoms rather than the proportion of mass, one finds that the proportion of Hydrogen atoms by number in the universe is 95% compared to about 5% Helium atoms; the fraction of the number of other heavier atoms being negligibly small. For our calculations in the following let us assume that the universe is all Hydrogen with its mass being $10^{54}$ kg. From physics we know that there are $6.02 \times 10^{23}$ atoms of Hydrogen in one gram of Hydrogen; which is also called the Avogadro number. Therefore, converting kilograms to grams by multiplying by 1000, the total number of Hydrogen atoms in the universe is:

$N_{H\text{-}total} = 10^{54} \times 1000 \times 6.02 \times 10^{23} = 6.02 \times 10^{80}$.

**Volume of all Hydrogen Atoms in the universe ($V_{H\text{-}total}$)**

Radius of a single Hydrogen atom = $5 \times 10^{-11}$ meters (i.e. Bohr radius)

Therefore the volume of one Hydrogen atom $V_H = 5.2 \times 10^{-31}$ meter-cube

If all Hydrogen atoms of the universe are brought together and compacted without leaving space between them, they all will occupy an approximate volume of

$V_{H\text{-}total}$ = (total number of Hydrogen atoms) x $V_H$

$= 6.02 \times 10^{80} \times 5.2 \times 10^{-31} =$ **$3.13 \times 10^{50}$** meter-cube.

Now, the radius of this compacted ball of Hydrogen can be calculated using the radius-volume formula used above. This yields the radius of the compact Hydrogen universe to be,

$r_{H\text{-}total} = 4.21 \times 10^{16}$ meters (or **$4.21 \times 10^{13}$** km).

To bring this number into some perspective, it could be compared to the radius of our solar system up to the orbit of the last planet Neptune, which is about $4.503 \times 10^{9}$ km. One finds that the radius of the compact Hydrogen universe, $r_{H\text{-}total} = 4.21 \times 10^{13}$ km, as calculated above, is about 10,000 times the radius of the solar system. Therefore, the radius of the compacted Hydrogen universe well exceeds the expanse of our solar system. The nearest star to the Sun is the Proxima Centauri, about $4 \times 10^{13}$ km from the Sun. This means that if all Hydrogen of the observable universe is compacted into a ball with the Sun at the centre, the ball will occupy the space around the Sun with its surface just touching the next star from the Sun. In comparison our Milky Way Galaxy is much bigger than that. A comparison between the radius of the present observable universe and the compacted universe tells us that the radius of the observable universe is greater than the radius of the compact Hydrogen universe by a factor of about $10^{12}$. When one compares the volume of the compact Hydrogen universe with the present estimated volume of the observable universe, one finds that the volume of the universe is bigger than the compacted Hydrogen universe by a factor of $1.1 \times 10^{30}$. Now let us see whether we can bring the matter of the compact Hydrogen universe even closer to approach a *tuchchhaya* volume!

# Hidden Dynamics in the Compact Hydrogen Universe

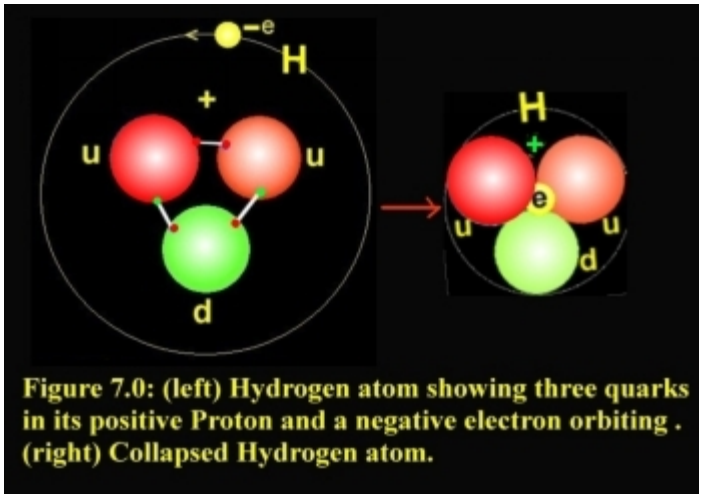


**Figure 7.0: (left) Hydrogen atom showing three quarks in its positive Proton and a negative electron orbiting . (right) Collapsed Hydrogen atom.**

If all Hydrogen atoms in the compact Hydrogen universe are brought to a stand-still, one could imagine that such a universe is in a complete static state. But that would be illusionary because such a static universe has a lot of hidden dynamics still left inside each Hydrogen atom. Consider a Hydrogen atom labeled H in the Figure 7.0 (left side outer circle). Its nucleus is made up of a proton with one positive electric charge on it. The proton is made up of three quarks (u, u, d). One negatively charged electron (-e) orbits around the proton at a very high speed of about 2 million meters per second. In the compact Hydrogen universe, even if all protons $N_{H\text{-}total} = 6.02 \times 10^{80}$ were brought to stand-still the same number of orbiting electrons still have a lot of kinetic energy. Each of these hidden electrons is orbiting at a distance from the centre of the proton called the Bohr radius. The Bohr radius of the Hydrogen atom forbids all other protons to come closer into contact with each other. Therefore, there is still a lot of kinetic energy hidden in the compact Hydrogen universe even if all Hydrogen atoms are brought to a stand-still.

To go closer to the slumberous state of matter of the universe these orbiting electrons must also come to a complete halt. One can achieve this if somehow one collapses the orbiting electrons into their respective protons. This is symbolically exhibited on the right-side in the Figure 7.0. Upon such a collapse the negatively charged electron will neutralize the positively charged proton. Let us assume that since an electron weighs only about $2000^{th}$ of a proton mass, the collapse of a single electron into a single proton will not appreciably increase the volume of the proton. Therefore, for the rough calculation here one can assume that the proton's diameter formed by three quarks will remain about the same. As depicted in Figure 7.0 the Hydrogen atom having the orbiting electron (left side) was obviously bigger in size than a proton alone (right side).

At this point let us recall from Chapter 2, the four fundamental forces in Nature, "strong", "weak", "electromagnetic" and "gravitational" forces that govern the matter of the universe. Let us also assume here that the "strong" force, effective at molecular ranges and the "gravitational" force effective at all ranges, that keep the matter of the universe together, are still operational to keep all the collapsed Hydrogen atoms in a compacted blob of matter.

Now let us do the final calculation of the volume of the universe occupied by neutralized protons which are basically the neutrons.

Radius of neutron = 1 x $10^{-15}$ meters

Therefore the volume of one neutron is $V_n = 4.2x10^{-45}$ meter-cube

Volume occupied by all neutrons in the compact universe is $V_{n\text{-}total} = N_{H\text{-}total} \times V_n$

$= 6.02x10^{80} \times 4.2x10^{-45} = 2.53 \times 10^{36}$ meter-cube.

The volume ratio between the observable universe and the compact-neutron universe is,

$V_{univ} / V_{n\text{-}total} = 3.57x10^{80} / 2.53 \times 10^{36} =$ **$1.41x\ 10^{44}$**.

Calculating the radius from the volume one gets the radius of the compact neutron universe $r_{n\text{-}total} = 1.362x10^{12}$ meters.

The reduction factor between the present universe and the compacted -universe is $R_{uviv\text{-}N} = r_{univ} / r_{n\text{-}total} = 4.4x10^{26}/1.362x10^{12} = 3.23x10^{14}$.

The reduction factor between the Hydrogen compact universe and the compact neutron universe is, $R_{H\text{-}n} = r_{H\text{-}total} / r_{n\text{-}total} = = 4.21x10^{16} /1.362x10^{12} = 3.1x10^{4}$.

**This is a further reduction by a factor of 31,000**.

The radius of the compact neutron or proton universe being $1.362x10^{12}$ meters, this completely inactive universe, would be confined well within our solar system. The distance from the Sun to the planet Saturn, which is inside the orbits of the two outer planets, Uranus and Neptune, is about $1.435x10^{12}$ meters and the distance between the Sun and the last planet, the Neptune, being $4.503x10^{12}$ meters, the compact neutron universe can be accommodated within one third of the solar system.

With its mass given and volume estimated above, the density of matter in such a universe would be about 0.4 x $10^{15}$ grams per centimeter cube compared to the density of water being 1 gram per centimeter cube. Matter with 1000 trillion times the density of water is an undefined entity.

In this hypothetical math exercise the observable universe, in terms of volume, going down from $3.57x10^{80}$ meter-cube to 2.53 $x10^{36}$ meter-cube, means that the volume of the universe has gone down by a factor of $1.41x10^{44}$ which in common language is 141 million-trillion-trillion-trillion. This is going from 'colossal to *tuchchhaya*'. When we let the orbiting electron collapse into proton, the positive charge of the proton is neutralized and it is like a neutron. The matter at such a state is neutral and without any diversity. For the Vedic scenario of the universe this is for all

practical purposes the *salilam Asata* uniform state of matter confined within the *tuchchhaya* volume, which in the above calculations for the observable universe, is confined within one third of our solar system. It is not a 'nothing'!

A proton (or a neutron) is made up of three quarks which, as discussed in Chapter 5 under Nature (*Prakriti*), are in the likeness of the 'tri-property' *aapah* particle with the three classes of matter, *sata-raja-tama*. If one had known the space between the three quarks forming a proton, one could further shrink the neutron universe into an even more compact quark universe, thus putting the observable universe in a further diminutive *tuchchhaya* Space.

The underlying thought process in going through these hypothetical calculations is that the Vedic universe has a beginning from a small Space but it never goes down to 'nothingness'. If one assumes that the compact proton or neutron universe is in the likeness of Nature in the dissolution phase occupying a *tuchchhaya* Space, the beginning of the universe could supposedly have taken place from here. Then no unnatural and hypothetical Cosmic Inflation is needed which seems to have become the soul of the modern Big Bang Hypothesis. This Cosmic Inflation is hypothesized to have lasted from $10^{-36}$ second to $10^{-32}$ second after the onset of Big Bang when the universe was presumably about a few meters wide. The Big Bang Hypothesis hinges on this hypothetical phenomenon without which the hypothesis is as good as dead.

Recall the statement of the Taittireeya Upanishad that the *collection* (togetherness) *of the ubiquitous Aakaash (Space-entity) reveals its existence* and differentiates it from the Nature (matter) and the Creator. Also, the *Pushkaram* synonym ($15^{th}$ in Table 5.6) of the Space-entity implies that it expands (swells) with the universe like a flower which begins with a minute bud and opens to a large full bloom. The Veda has said it in different ways that the *Asata* to *Sata* transition is from *tuchchhaya* to colossal.

The first step in the Vedic Creation scenario is to apply the Creator's $\mathbf{E_{e\text{-}m}}$ energy to the Nature in *Asata*-state. The other energy terms $\mathbf{E_h}$ and $\mathbf{E_r}$ are simultaneously developed in the primordial matter as an after effect of $\mathbf{E_{e\text{-}m}}$; however, the process is arbitrarily shown in several steps.

## **Step-1:** The Effect of the Creator's *Eekshana-Munn* Energy $E_{e\text{-}m}$ on the *Asata*-state (A)

The subject of the fourth mantra of the RigVeda's *Bhaavavrittam sukta* (RigVeda, 10/129/4) - काम[1]स्तदग्रे[2] समवर्तताधि मनसो[3] रेत:[4] प्रथमं[5] यदासीत् (*kaam*[1]*astdgre*[2] *samvartataadhi manso*[3] *retah*[4] *prathamam*[5] *yadaseet*)…., sets out the first step in the Vedic Creation Scenario, where *Bhaavavrittam* discussed in Chapter 6 means the "*History of Creation of the Universe*". A full interpretation of the mantra is in Chapter 6, however, for the sake of continuity the full translation of the contextually relevant part of the mantra is invoked here with the difference that five specific terms are superscripted and their corresponding English equivalent terms are identified below with the same superscripts. The part mantra is given below-

> "*At the beginning*[2] *of creation, the kaamh*[1] *(Eekshana) of the Creator puts the absolute first-seed*[5] *the Munn*[3] *entity (mind) in the retah*[4] (रेत:) *the causal state of the inert Nature….*". ( RigVeda, 10/129/4).

The first step according to this mantra is to add *kaamh*[1] *(Eekshana) of the Creator* to the inert Nature in *Asata*-state. *Kaamh*[1] (*eekshana* = 'desire' being its colloquial meaning), a virtue in a conscious-being, rises in the *munn*[3] (mind) of the conscious-being, results in developing the *Eekshana* energy $\mathbf{E_{e\text{-}m}}$ which could be put to use for a material gain. In the case of the conscious-being Creator the conscious *Munn*[3] (Mind) of the Creator serves as the *first-seed*[5] in the Nature (matter). It is this priming of the matter with a unique non-physical energy $\mathbf{E_{e\text{-}m}}$, imparted by the conscious *Munn*[3] of the Creator, which changes the indefinable *Asata*-state of Nature into a definable *Sata*-state of Nature, such that its every sleepy *retah*[4] particle is awakened finding itself embedded in the field of $\mathbf{E_{e\text{-}m}}$. This step is depicted in Figure 7.1 with the letter **A** representing the *Asata*-state of Nature to which $\mathbf{E_{e\text{-}m}}$ is added to transform **A** into the *Sata*-state **S**.

It is the energy $\mathbf{E_{e\text{-}m}}$ of a metaphysical nature that is instilled by the all-pervading Creator's *Munn*[3] into each and every *retah*[4] (रेत:), the most fundamental particle of matter, inspiring it to take part in the creation. This

author used the term "inspiring" for an inert particle, intentionally, but only metaphorically because a similar situation occurs on a small scale in a living-being. A non-material thought arises in the human mind (*kaamh*[1]), it energizes ($\mathbf{E_{e\text{-}m}}$) the material cells (*retah*[4]) in the hand of the human-being and the hand is inspired to do the required action - thus converting the metaphysical energy $\mathbf{E_{e\text{-}m}}$ into the mechanical energy in the hand. In the case of the Creator's *Munn*[3], it infuses properties of matter enabling each particle to participate in the creation under the ritam and satyam rules of the Creator. The preset Nature's rules that humans discover while studying modern physics are the four-forces discussed in Chapter 2. They are preset because a modern physicist does not know what created them or how they evolved in Nature to be so.

The properties of mass, charge, dynamics and so on acquired by each fundamental particle of the matter-conglomerate A in Figure 7.1, transform A into S. The result is the swelling of the matter into the *Sata*-state S on the right side of the Figure 7.1. This is equivalent of saying that the tri-property Vedic-defined Nature, a conglomerate of three types of fundamental particles *sata, raja* and *tama* emerges from its sleepy inactive state into an active and definable state of matter.

The Vedic creation, as mentioned before, is not based on a known mathematical model with measures of time, space, temperature and mass of the universe. There are however quite a few exceptions that this author has noted where the Veda has assigned hard numbers which had to have been the result of rigorous mathematical treatment; one example being the time duration of 4.32 MY assignment to the incubation period of the *Mahat-aand* (Great-ovate) before it explodes into uncountable future celestial bodies forming the universe. The mantras (discussed in Chapter 6) reveal that the initial process for sending the Nature from *Asata*-state to the *Sata*-state is instantaneous. For the purpose of visualization that instantaneous moment has been split in the display of the cosmology scenario shown in Figure 7.1. The sequence of the progress is depicted by the arrows. The addition of $\mathbf{E_{e\text{-}m}}$ to the *Asata*-state A of Nature renders the *Sata*-state S, shown as the enlarged dark sphere.

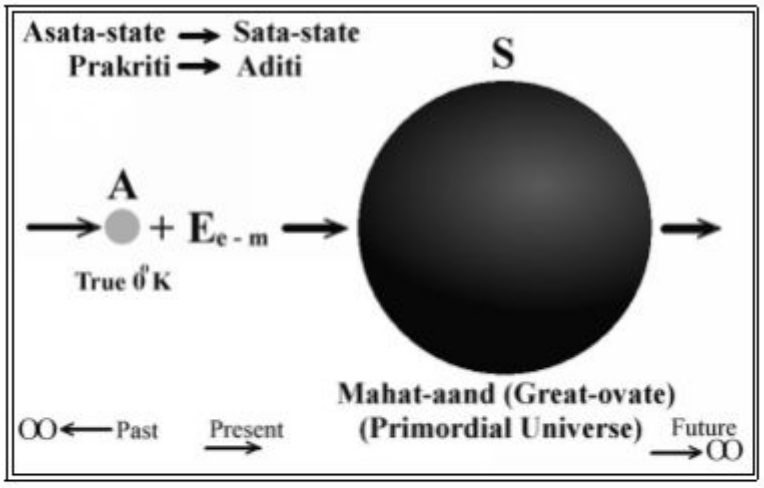


**Figure 7.1**: The tri-property *Prakriti* (Nature) in indefinable *Asata*-state **A** is depicted by a small grey sphere on the left. The initiating *Eekshana* energy $\mathbf{E_{e-m}}$ energizes all tri-property *aapah* (fundamental particles) bringing them into the definable *Sata*-state **S**. The development of the fundamental properties in matter swells the volume of the primordial universe.

The newly manifested *Sata*-state S at this moment is an active state but not yet an interactive state when the matter of the universe would begin to form energy and matter. At this stage the primordial matter of the universe is awakened acquiring specific properties, yet it is cold. The *Sata*-state **S** in Figure 7.1 is shown to occupy the spherical shape which is possible when the particles acquire mass and exert gravitation on each other. This means that the physical laws of Nature are already in the *Sata*-state of matter. The spherical shape of this early dark universe is indicative of the most probable shape acquired by matter in corpuscular form with the property of gravitation in it. This is in similitude of most celestial bodies like the Earth, the Sun and so on. This by no means suggests that the three types of *aapah* particles, *sata-raja-tama*, start moving around like gas molecules in a container. At this moment of the creation the *aapah* are said to have reversed their nature from inactive to active. Any change in an *aapah* is expected to physically change it. The least that could happen to an individual particle is to swell. Recall the above calculations; a Hydrogen atom with an electron revolving around its nucleus (proton) is 50,000 times bigger than the nucleus (proton). When each particle swells, the whole Nature is expected to swell increasing the Space entity holding it. This led

to the Vedic adjective of *Pushkaram* for the Space-entity - that it swells like a flower.

## Present Universe begins at Time $t = t_{n,0}$

The Time in the Figure 7.1 runs from minus-infinity (- ∞) in the past to the present and points towards the plus-infinity (+ ∞) in the future. The perpetual cycle of *srishti-pralaya* (creation-dissolution) of equal periods termed as *kalp* and *vikalp* dictates that an infinite number of creations have taken place before the present creation "*in semblance of the present kalp"* (RigVeda, 10/190/3, discussion in Chapter 6) and an infinite number of creations are to come after the present creation is dissolved. Since the Time-entity of the Vedas (discussed in Chapter 5) is a continuum from - ∞ to + ∞ on which the wave of *kalp-vikalp* rides, one can assign an arbitrary index n to represent the present $n^{th}$ universe. The onset of the $n^{th}$ universe on the Vedic time-continuum at time $t = t_{n,0}$ is equivalent to time t = 0 seconds in modern Big Bang Hypothesis.

## The Nature as a Progenitor of Cosmos is termed as the *Aditi*

The *Prakriti* (Nature) in each creation begins as an embryo in the *Asata*-state, sleeping in the embryonic-sack of *tuchchhaya* Space. This embryo of inert matter is addressed as the *Hiranya-garbh* (Golden-embryo) and when it takes birth, stretching its sack to fill the *Vyom* (vast Space) with celestial objects, it is addressed as *Aditi*. The *Aditi* is the universe and universe is the Nature. In the English language the term 'nature' is common to all stages of the universe; when matter transits from its indefinable state in the Planck time regime to its later utilizable state for the rest of the creation. In the Vedic cosmology on the other hand a synonym of Nature is used which most appropriately describes the stage of creation.

The non-utilizable state of *Prakriti* (Nature) has several synonyms for its *Asata*-state, like *salilam*, which in its creation phase changes to *Aditi* because in this phase its function is to serve as a progenitor of the cosmos (synonym 4 in Table 5.1). The term *Aditi* is specifically used in RigVeda's *Deva sukta* 72 of chapter 10. The nine mantras of this *sukta* delineate how *Aditi* created the first entities and systems of Nature. The etymology of the Sanskrit term '*aditi*' leads to - '*one that is a real consumable entity for*

*creation'* or *'one that is in utilizable state of Prakriti'*. The *Aditi's* first act according to RigVeda's "*deva sukta*" is to give birth to the *devas*. The *devas* in this context are Nature's specific inert primary properties and systems that help initiate the creation and sustain it for the rest of the universe's life till its dissolution. Before the *'Deva sukta'* of RigVeda is presented, a few related thoughts are presented.

## Vedic Creation begins at True Absolute Zero Temperature

The compact Vedic terms are the wonders of the Sanskrit language that at times required interpretation by post-Vedic *rishis* to reveal their dimensions in applied meaning for the understanding of the common people. A single term at times contained a full-fledged definition or a property of a substance or the behaviour of a phenomenon or a hidden principle. The term *salilam* in RigVeda (10/129/3) is one such term that defines the state of Nature in its causal-state. In the dissolution (*pralaya*) phase all three of Nature's fundamental particles, *sata-raja-tama,* are uniformly mixed and confined in a relatively smaller space (*tuchchhaya*) that is completely devoid of radiation (Chapter 6, deductions 7 and 8). The expression 'devoid of radiation' here means that no light-emitting mechanism in the atoms and molecules or in the fundamental particles exists when *Prakriti* is in *salilam* state.

In addition to the RigVeda mantras in the *Bhavavrittam sukta* (Creation of the Universe), Manu in his Manusmriti (1/5) also expressed what existed and what did not in the *salilam* state of matter and addressed it with the adjective of प्रसुप्तमिव सर्वत: (*prasupthmiv sarvatah*) meaning – *like in deep slumber in its entirety*. Rishi Kapil in his Saankhya Sutra (1/26) addressed the *salilam* state of Nature in terms of the state of matter declaring साम्यावस्था प्रकृति: (*saamyaavastha Prakritih* (Nature). This meant that in the *salilam* state of matter – *the Nature was in a uniform dissolved state*, without any diversity in its matter. Thus the Vedic creation begins with matter at its fundamental state with complete absence of any activity in it. Such a state occurs when there is no diversity or any separation of properties in matter; unlike in the creation phase of the universe. In the created universe a gold atom is different from a silver atom and a Hydrogen

atom is different from a Helium atom and so on. Even within a single Hydrogen atom its electron in extremely high orbital motion around its centre is separated from its proton and both have diversity in their mass, charge and state.

All such differences present during the universe in the creation phase disappear in the *salilam* state of Nature. This *salilam* state of Nature is with zero dynamics even inside the fundamental particles of matter that form the nuclear particles, the protons and neutrons. In the creation phase the term *salilam* is used to express fluidity of the quantized state of matter in *sata, raja, and tama*; particularly for the ubiquity of the invisible *Aapah-devata*.

The state of matter is the defining difference between the modern Big Bang Hypothesis and the ancient Vedic Big Bang. In this author's understanding a complete absence of kinetic energy, externally and internally, is the *salilam* state. Since the temperature in a body appears due to the motion of its components, the *salilam* state is expected to have no indication of temperature. It must be at True Absolute Zero Temperature. The meaning of "True Absolute Zero" is explained in the following.

The minimum attainable temperature that a substance can reach is defined as the "Absolute Zero Temperature" or the "Absolute Zero Kelvin". For the reasons given below this author has introduced here a new expression, the "True Absolute Zero Temperature". To understand this new term with clarity, let us recall the discussion on kinetic energy and the absolute temperature scale from Chapter 2. Let us also begin with atomic Hydrogen in a container at normal temperature and pressure. Although not visible in the container the atoms of Hydrogen gas are in constant motion, known as the Brownian motion. They are moving around colliding with each other and with the walls of the container. These speeds of all Hydrogen atoms collectively give rise to an average kinetic energy of the Hydrogen gas. This kinetic energy is exhibited as the temperature of the gas, which therefore is also the temperature of the container. The energy is termed as the kinetic energy of the system. The temperature of a substance is the index for the presence of heat energy; the higher the temperature the higher is the energy in the substance. Therefore the kinetic energy possessed by the atoms of Hydrogen is equivalent to the heat energy in the container. This heat energy can be taken out by cooling the container. When the heat of the container is transferred out by cooling the container, it is also equivalent of saying that the Hydrogen atoms inside the container have

collectively slowed down. Since this kinetic energy is internal to the Hydrogen gas it is also addressed as the 'Internal Kinetic Energy'.

When Hydrogen gas is subjected to extreme cooling, it turns into liquid at 20.28°K (-252.72° C). When it is cooled further the liquid Hydrogen turns into solid at 14.01°K (-259° C). Even though this temperature of solid Hydrogen is extremely low and the Hydrogen atoms are no more detached from each other to move around, the existence of temperature in the solid Hydrogen is indicative of the fact that the Hydrogen atoms in it still have some motion. This motion is due to the vibration of atoms around their positions. If the Hydrogen is further cooled down to 0°K, which is called the "Absolute Zero Temperature", one could safely say that all Hydrogen atoms have come to a complete halt. Reaching this state is difficult in a laboratory for any substance. The lowest temperature thus far reached in a physics laboratory is said to be 100° pK, which is 100 trillionth of a degree. This is very close to 0°K where the system is completely devoid of kinetic energy; however, what we usually do not think of is that each atom within itself is still a dynamic system.

The diagram of a Hydrogen atom in Figure 7.0 shows that the orbital electron is in perennial motion around its nucleus at a speed of over 2.19 million meters/sec. This is a highly dynamic situation carrying tremendous kinetic energy unaffected by the cooling process and is not a part of the "Internal Kinetic Energy" mentioned above. Let us call this hidden kinetic energy inside the atom as the "Latent Kinetic Energy". Contrasting with the simplest and smallest Hydrogen atom, an atom of gold having 79 electrons orbiting around its nucleus with 158 nuclear particles (protons and neutrons) contains a much bigger pool of this Latent Kinetic Energy. Thus the matter in the entire Nature is full of 'Latent Kinetic Energy'. Whether there is any dynamic activity inside a quark is yet to be ascertained by physics, however, the spin motion in the three quarks forming the nucleus of Hydrogen would further add to the Latent Kinetic Energy.

There is always a possibility in a low temperature physics laboratory to bring all the Hydrogen atoms in a container to a complete rest by cooling them down to the 0°K but there is no physics possibility to bring the electron inside the atom to a complete rest without compromising the integrity and existence of the Hydrogen atom itself. This means that under the normal conditions, the Latent Kinetic Energy in the atoms of the universe will continue to exist for the life of the universe. This invariant

feature of matter is the nature of the Vedic defined *Sata*-state of matter forming the Vedic *srishti* - the creation.

Logically speaking wherever there is energy, there is its corresponding temperature. Therefore this Latent Kinetic Energy must also correspond to a Latent Temperature. Without discussing the details of the kinetic energy-temperature formula here but using the velocity of the orbiting electron as $2.19 \times 10^{6}$ meter/sec and its mass as $9.1 \times 10^{-31}$ kg one gets the equivalent temperature corresponding to the Latent Kinetic Energy within a Hydrogen atom alone as 105,372°K. This temperature is not exhibited outside a Hydrogen atom but logically it is latent (hidden) there. This high temperature hidden within a Hydrogen atom is not affected even if the Hydrogen is cooled down externally to the Absolute Zero Temperature, the 0° Kelvin.

Also, logically speaking, the primary Absolute Zero Temperature is when there is no Kinetic Energy. If there is kinetic energy inside a Hydrogen atom corresponding to the temperature 105,372°K the Kelvin Absolute Zero Temperature reached externally is only secondary. Bringing such a high latent temperature owing to the Latent Kinetic Energy inside the Hydrogen atom down to zero by bringing the dynamic of the orbiting electron to zero must be defined as the 'True Absolute Zero Temperature'. Presently such a definition of temperature does not exist in modern physics. In a symbolic presentation, this 'True Absolute Zero Temperature' is below the Absolute Zero on Kelvin scale by –105,372°K. This author's interpretation of the *Asata*-state of matter in the Vedic Cosmology is that before the creation begins in the *Asata*-state of Nature, every matter particle is at this 'True Absolute Zero Temperature' where all motions cease to exist inside and outside of an atom. In the Vedic expression such a state of matter is said to be in the 'slumberous state', devoid of the *Vaayu-devata* – the *devata* of motion.

Now imagine that the universe is a container with all its matter enclosed in it. Next consider a scenario similar to the one discussed above with regard to *tuchchhaya*-space where the state of matter loses all its kinetic energies – internal as well as latent with its temperature at 'True Absolute Zero Temperature'. When this scenario is envisaged in successive steps from the present creation towards dissolution, one finds that first the motion of all free atoms will stop and then the motions of Earth and other planets around the Sun will stop. Stopping of all planets means that they

will all fall into the Sun under its gravity. Then the Sun will stop its orbit around the Milky Way Galaxy and merge into the Milky Way Galaxy along with all the stars and so on. Then the universe will lose its diversity, merging all galaxies into a single blob of matter. Finally all matter at its fundamental level loses all its diversity; its internal and latent energies are taken out of it. All matter of the universe in this final stage is at True Absolute Zero Temperature. In such a state the entire universe is confined in a small space (*tuchchhaya* -space). This is the *Salilam*-state of *Prakriti* (Nature). Such a non-active blob of indefinable matter is the *Asata*-state of matter depicted by the small grey sphere **A** in Figure 7.1. In this author's thinking a temperature of True Absolute Zero Degree K could occur only when even the Latent Kinetic Energy inside each fundamental particle ceases to exist.

The low temperature physics laboratories will one day succeed in reaching closer to 0°K, however, they would not succeed beyond that because taking out the underlying Latent Kinetic Energy from inside an atom may remain an unachievable feat. It is however possible to separate an orbiting electron from its proton inside a Hydrogen atom, but what we are talking about here is to make the electron to slow down and ultimately merge into its parent proton. In this author's view, because the Latent Kinetic Energy that this author defined above is still there inside the atoms, a True Absolute Zero cannot be reached. To put it in the context of the creation of the universe, this author's deduction is that the "conventional 0°K" could be reached in a physics laboratory but a True Absolute Zero cannot be reached during the creation-phase because the matter as defined in the Vedic *Asata*-state can never be created during the creation-phase of the *Sata*-state. In other words, the *Eekshana* energy $\mathbf{E_{e\text{-}m}}$ of the Creator in the creation phase has impregnated each fundamental particle of matter with energy that is impossible to reverse. An interesting way of stating the outcome of the above discussion is:

***A True Absolute Zero Temperature resides with the Creator.*** (Shiv Raj Pal, 2008).

Many hypotheses in science have been put forward in the past to make progress in human knowledge. Some have been proven valid and moved

forward the cause of science (knowledge). Even those proven invalid have served as the base for new and better hypotheses to move research forward. With these thoughts and the way the Vedic principles have been interpreted by this author, a hypothesis on 'True Absolute Zero Temperature' could be formulated thus:

> ***"Motion being an inherent nature of matter with its tri-property of sata-raja-tama being active during the creation-phase of the universe, a True Absolute Zero Temperature is unreachable."*** (Shiv Raj Pal, 2008).

## *Vaayu* the *Devata* of Motion and the Latent Kinetic Energy

A *devata* in the context of matter is matter's (Nature's) distinct inherent property that is essential in the sustenance of the creation. As an example the property of electricity in matter is *Indra-devata*, without which the creation cannot come into existence and cannot be sustained. Likewise the inherent property of motion in matter is the *Vaayu-devata*. In the example of cooling the Hydrogen in a container and reducing motion (kinetic energy) of Hydrogen atoms would be interpreted in the Vedic perspective as reducing *Vaayu-devata* in Hydrogen. The *devata* of motion responsible for Kinetic Energy in substances at all levels of creation is Veda's *Vaayu-devata*. The *Vaayu-devata* is not something that is only inside an atom, as in the example of a Hydrogen atom; being an inherent property of matter, the *Vaayu-devata* manifests in all realms of the universe.

One observes myriads of movements and motions of objects in the creation with differing mechanisms behind them. This is expressed as the manifestation of the *Vaayu-devata* in differing forms. The Internal Kinetic Energy could be taken out of a system but because the Latent Kinetic Energy hidden inside the atoms cannot be removed, the *Vaayu-devata* will continue to be active throughout the creation phase of the universe. The same is true for all seven primary Vedic *devatas* including the *Agni* (heat energy), Som (chemical bond energy) and others. This is why the *devatas* are termed as the *brothers-in-immortality* (RigVeda, 10/72/5) to accompany

the creation till the end of the creation. This is further discussed under the sub-heading of, "Eight Progeny of *Aditi:* the First Entities of Creation".

All *devatas* vanish when the Nature goes from its *Sata*-state of creation to its indefinable *Asata*-state of dissolution. The matter in that state is at True Absolute Zero. It is thus obvious that a tremendous amount of extrinsic energy is needed to initiate the creation. Owing to the infinite nature of the Creator's all-pervading energy pool, the Creator is addressed by the Veda with several synonyms such as *Sarva-Vyaapak* (Omnipresent), *Sarva-shaktimaan* (Omnipotent). Therefore, symbolically the term $\mathbf{E_{e\text{-}m}}$ for the *Creator's Eekshana-Munn* energy is added to the *Asata*-state **A** in the Figure 7.1.

A formless thought in a conscious-being's brain gives rise to a physical action instantly. A thought in the Creator's *Munn* (mind) awakens each fundamental particle of Nature from *sushupti*, the metaphoric slumberous state of matter. The matter acquiring all properties necessary to ultimately form a tangible and functioning universe is the matter's awakening. The consciousness of the second-kind (souls), rewarded with the proportionate virtue of *eekshana-munn*, form their physical bodies equipped with the knowledge senses and become an integral part of this awakened creation. The process includes the engrafting of the critically balanced laws governing matter (Nature) and consciousness (spiritual).

Nothing in the universe is easy to comprehend completely; however, it is the physical realm of the universe that is graspable by humans and its governing physical laws are discoverable. Let us look at a few examples from the perspective of modern physics to show that there are laws of Nature that we discover and understand and there are laws that we cannot.

When an object falls on Earth we know that it is owing to the underlying law of gravitation- that we have discovered. But we do not know why the matter has the property of mass and the property of attraction and not repulsion and not neutrality. This author is not talking about how matter got the property of mass because a modern physicist would be eager to answer it by saying - Higgs particles gave mass to matter. This author's question is - why at all did a Higgs' particle develop the property that imparts mass to matter in the first place? Such questions have no clear answers in physics.

Another example relates to the electric charge. We have discovered that an atom is charge-neutral. But inside it are negatively charged

electrons, positively charged protons and neutral neutrons. What a coincidence that both, the property of mass and the property of charge, independent of each other, were necessary for the creation of the universe! We do not know how the process of the forming of atoms evolved in Nature, unaided by intelligent beings.

As soon as a photon of light is created in an atom, it shoots out with the speed of light without first accelerating to pick up speed. It could wait a while in the atom that produces it and then move or different photons could move with different speeds than one speed - the speed of light. The question here is not what conditions create displacement of objects; rather the question is why was the universe not born as a static blob? Thus, not all answers are in the *satyam* realm (the physical realm of the universe). The Vedas do not provide any obvious mathematical formulations for the laws of Nature to deal with the physical reality of the universe or for the laws governing the consciousness realm; they have put these laws respectively under the realms of *satyam* and *ritam*. The questions that have no answers or have answers difficult to frame, probably belong to the *ritam* (spiritual) realm. The physics ought to have answers to all questions about the Nature (matter). However, at times one has no answer to a question arising out of Nature. Then an unsatisfactory answer is - "that is the way Nature is."

The specific mention of *satyam* and *ritam* in the context of the creation of the universe does suggest that the creation takes place under specific laws that the matter (Nature) is to follow and that the creation is not a chaotic chance phenomenon evolving out of an accident because there is no science evidence of the law of gravitation adjusting or evolving to arrive at the present critical value. The laws of Nature exist from the beginning of the universe but the scholarly discover them later in the life of the universe after the consciousness has emerged.

## Appearance of Geometry, Mass and Gravitation in *Asata*-state of Matter

The matter of the pre-universe *Asata*-state, having no physical laws operating on it and having no properties that appear before the creation phase, will assume a physical shape that it is put into. If there was no mass and therefore no gravitational attraction between the fundamental *aapah* particles, the matter will assume the shape of the preexisting Space-entity

holding it. The most efficient space to hold corpuscular matter is in the form of a sphere. When the matter was concentrated in a *tuchchhaya* (diminutive) Space, as stated in RigVeda (10/129/3) or in the '*Navel of the Creator*' as in RigVeda (10/80/60), its optimum shape must have been a sphere. Transiting from the *Asata*-state to *Sata*-state acquiring new properties, it is expected to swell in all directions. This is symbolically shown in Figure 7.1 where the small grey sphere **A** (*Asata*-state) on the left transits into a bigger black sphere **S** (*Sata*-state) on the right. It is appropriately addressed as the *Mahat-aand* (the Great-ovate).

## Vedic Nomenclature for the Primordial Universe

The 'primordial matter' in modern cosmology is addressed with a few names, the common name being Georges-Henri Lemaitre's 'Primeval Atom'; its mathematical name being 'space-time singularity' or the 'Big Bang singularity'. In Vedic terminology it has been addressed with various names in both, the *Asata*-state and the *Sata*-state, based on the state of the matter, the properties, functions and the geometry. Some of the Vedic terms have already appeared in the above text; however, they are summarized with an explanation to show that the Vedic Cosmology is not a religious ad hoc belief; rather the thought process in the mantras is based on a scientific discipline, organized in a literary discipline and rendered with the discipline of Sanskrit terminology.

## Vedic Terms for *Sata*-state: the Primordial Matter

Of the 39 synonyms of *Prakriti* (Nature-entity, Table 5.1 in Chapter 5) several have been explained earlier, including *Aditi*. Several adjectives of Nature with cosmological relevance are briefly explained.

The primordial matter of the universe is addressed as the ***Mahat-aand*** when the context is its physical form in three-dimensions. The ordinary colloquial meaning of the suffix term '*aand*' is 'egg', however, its *yaugik* meaning (the root-based meaning) is "*a spheroidal object to create something out of it*". The meaning of the prefix term ***Mahat*** being 'great' the *rudhi* meaning (colloquial meaning) of the compound term ***Mahat-aand*** is the Great-egg. The term ***Hiranyam-aand*** (Golden-egg) and ***Hiranya-garbh*** (Golden-embryo) are for describing the next stage of the primordial

matter of the universe when the matter is in ovate form at high temperature. Implicit in the prefix term ***hiranya*** is 'brilliantly hot'. At this stage nothing is yet created and all the matter of the universe is together in a spheroid at high temperature. The terms ***Maart-aand*** (the Mortal-ovate, RigVeda, 10/72/7-8) and ***Prajapati*** (Progenitor and governor of the population of cosmos, RigVeda, 10/127/9, RigVeda, 10/168/3; Shatpath Brahmana, 11/1/1, 2) represent the left-over state of *Aditi* after 7 *devas* were created (to be discussed in the following). The term ***Braham-aand*** (*Brahmn*'s egg or *Brahmn*'s spheroid) is a general term which applies to all stages of the created universe, the *Braham* or *Brahmn* being the term for the Creator.

***Prajapati*** is a compound term for *praja* and *pati*. The *yaugik* meaning of the term *praja* is – "*those who have come into existence under supervision"*, the *rudhi* (common) meaning being "*the governed population"*. The term *praja* represents plurality. Its applied meaning is the 'population' or 'subjects' as in subjects of a ruler. The term *pati* has several meanings conveying basically the same thought. It stands for a progenitor, an originator or a governor of the *praja*. In common usage a father is a *prajapati* of the children he has given birth to and looks after. A great ruler of a nation whose subjects (*praja*) idolize him also attains the status of a *prajapati*. In the context of the creation, the term *Prajapati* is also used for the Creator *Brahmn*, because all cosmos and living beings are His *praja*. However, in the context of the universe as a physical phenomenon of Nature, as in the above mantras (RigVeda, 10/127/9, RigVeda, 10/168/3), the term *Prajapati* is for *Prakriti* the Nature-entity, for it is the progenitor of its *praja* made up of the cosmos. As explained below, the context will determine which meaning of the term applies.

In a single mantra of YajurVeda (21/63) the terms *Svayambhu* for the Creator and *Prajapati* for the Nature as the embryo for creation have appeared simultaneously, thus representing two distinct entities. The *Prajapati* (Nature) in this mantra is stated to be in the womb of the *Svayambhu* (Creator). In the metaphor of a mantra discussed in the following the *Prajapati* (Nature) is in the womb of the Creator. The Creator's womb in many other Vedic references is a metaphor which means – within the Creator. The Veda defines the Creator to be a formless unitary entity with His existence all-pervading beyond the entire creation. Therefore, in the context of cosmology, the term *Prajapati* is used for the

inert Nature in the creation phase: a progenitor of the celestial bodies that are its *praja*.

The term *Hiranya-garbha* means Golden-embryo or Brilliant-embryo. All these terms mentioned here represent a hot 3-dimensional (3-D) conglomerate of matter. The Shatpath Brahmana reference (11/1/1/1-2) stated– "*...In those heated aapah was created the Hiranyam-aand (golden-ovate)...*". The Brahmana statement in its entirety reveals much more and therefore is discussed in detail under the 'Step-3' to follow. That the Golden-embryo is an extremely hot 3-D conglomerate of primordial matter also becomes obvious from several other Veda mantras. In the depiction of the figures in this book the symbolic colour of *Aditi* changed from cold black at True Absolute Zero Temperature in Figure 7.1 to red-hot at extremely high temperatures through the Figures 9.1 and 9.2.

The transitional stages of matter from *Prakriti* to *Aditi* are well-depicted by an AtharvaVeda mantra,

> "***Prajapati*** *(Nature in creation phase) remains* ***a-drashmaan*** *(non-observable, indefinable) in the interior of the* ***garbh*** *(womb) of the Creator, becomes active, populates this universe in multitudes and thus reveals itself…*" (AtharvaVeda 10/8/13).

What else was hidden in this primordial blob of matter made up of tri-property *aapah* that also came into existence is answered by the following RigVeda mantra,

> *"In the beginning,* ***all devas*** *and the* ***cosmos***; *the* ***embryo*** *of the universe itself, all exist in togetherness as the* ***aapah*** (the fundamental particles of matter) *concentrated in the navel (centre) of the Creator…*". (RigVeda, 10/82/6).

This mantra stipulates that in the beginning, before the creation began, the two forms of matter – all ***deva*** matter/energy fields and the observable **embryo** of the universe to give birth to **cosmos** were concentrated and hidden together in the form of the fundamental state of matter called ***aapah*** and all *aapah* were in the centre of the Creator. The meaning of all matter concentrated in the navel of the Creator is that the universe was in the

indefinable *salilam aapah* localized in the Creation Energy field. The *devas* are created first from the embryonic state of matter and then the observable objects of the universe are created from the rest of the matter.

The adjectives with suffix "*aand"* for describing an ovate appear frequently in the Vedas and therefore in the rest of the subsequent Vedic Literature. The shape of *Aditi* the Nature in its procreation stage, appropriately addressed as the ***Prajapati***, is also said to be an ovate in its beginning. The Taandya Brahmana, the Brahmana-commentary book on the third Veda (SaamVeda) specifically assigns proportions to its dimension as,

> *"With certainty the extent of Prajapati was the same in upward direction as on its sides."* (Taandya Brahmana, 18/6/2).

One interesting observation on the above statement is that the *rishi* talks about the dimension of an object of celestial proportions. Obviously, cosmology was on his mind. The statement of the *rishi* makes it clear that the *Prajapati* was a spherical object to start with because in a three-dimensional symmetric spheroid the upward dimension is the same as its sides. It is becoming clearer from the references cited above that the *rishis* are talking about an observable object in embryonic stage that is going to create the cosmos. Because there are no religious over-tones in these mantras, one can assign them entirely to cosmology. This and several other such statements including the adjectives that are prefixed with '*aand*', lead us to think that the ***Prajapati*** started in the shape of a three dimensional spheroid. It is the *Maart-aand* or *the Brahm-aand* that assumes the adjective of ***Hiranya-aand*** (Golden-egg) and ***Hiranya-garbh*** (Golden-embryo) which turns into a red-hot ovate owing to the heat energy $\mathbf{E_h}$ developed as a result of the physical forces and properties born in matter due to the initiating energy $\mathbf{E_{e\text{-}m}}$.

## Higgs Particle or God's Particle and the Vedic Perspective

The total mass in a piece of matter is due to the collective mass of all fundamental particles that form it. How the fundamental particle gets mass is the subject of Standard Model in Particle Physics. Theoretical and experimental Particle Physics have led to the discovery of a large number of

fundamental particles with differing properties such as: stable, unstable, with spin, with charge, charge-neutrality, with mass, mass-less and so on. An example of a mass-less and charge-less particle is the photon of light that carries only the force of its field. A fundamental particle with mass and negative unit charge is an electron. However, particle physicists continue to be puzzled over how fundamental particles acquired mass: right in the beginning of the universe or when exactly in the life of the universe?

A British physicist Peter W. Higgs in 1964 proposed a solution to this problem. He hypothesized that there existed an omnipresent energy field of special particles throughout the early universe which imparted the property of mass to all other types of particles when they moved through such an energy field. Higgs particle has not been discovered yet however the Higgs' hypothesis yielded positive results in predicting theoretically and confirming experimentally several deductions of the Standard Model. To keep this section at the level of a general reader it should suffice here that this mass-inducing particle is a boson type particle with no spin, no electric-charge and no colour-charge. It is very unstable, decaying into other fundamental particles within an extremely short time, of the order of $10^{-22}$ seconds ($10^{th}$ of a billion-trillionth of a second). A boson type of particle is the one that obeys the Bose-Einstein statistics (the Boson name is after the Indian physicist Satyendra Nath Bose). This led to naming such a particle as Higgs boson or Higgs particle and the corresponding energy field as Higgs field. After the Nobel Prize-winning physicist Leon Lederman in his book called it the God Particle, the nick-name stuck to it in spite of the displeasure shown by Higgs and other physicists. It is hypothesized that the Higgs field is self-sustained having its own source of energy. Physicists have predicted and detected many types of fundamental particles but the search for Higgs Boson continues with Particle Accelerators in USA and Europe.

It is said that at one time, Stephen Hawking bet one hundred dollars with the particle physicist Gordon Kane of the University of Michigan, that physicists would not discover the Higgs boson. Hawking conceded defeat when the researchers with the Large Hedron Collider at CERN (Conseil Européen pour la Recherche Nucléaire), over 40 years of search, announced on July 4, 2012 that they had discovered a new particle with the mass of about 126 billion electron volt, which is equivalent to 126 times the mass of a proton, which is also equivalent to about 126 times the mass of a

Hydrogen atom and they claimed that it is the Higgs boson. Scientists feel that more new data are needed to confirm that Higgs boson exists. It is rather difficult to grasp that a particle 126 times heavier than a Hydrogen atom is difficult to isolate. The fact is that this so-called God particle continues to be elusive. Does it exist or does it not? For now only God knows!

The question - how and when does a fundamental particle get the property of mass, is common to both, Particle Physics and Vedic physics (cosmology). Let us seek to answer this question with an alternate perspective.

If a sugar crystal is broken into minute specks, each speck is expected to reveal sweetness. Extending the analogy of sweetness to mass in matter it would not be far-fetched to say that if a piece of matter is broken into its most fundamental corpuscles, the property of mass would be revealed by each corpuscle. It would also be logical to say that if the corpuscle of matter is broken into one thousand pieces, each piece would reveal one thousandth of the mass of the corpuscle. Therefore one can deduct that the mass in a particle pervades through all the matter of the particle.

When it is theorized that the fundamental particles of matter acquire the property of mass when they pass through the Higgs boson particle field, several questions arise. Higgs particles must have the property of mass in them to impart that to another non-mass fundamental particle, then: (1) where did Higgs particles get the mass from? (2) what mechanism transfers the mass from Higgs particle to a non-mass fundamental particle? (3) what mechanism forbids the mass to just attach itself to the surface of the non-mass particle allowing it to pervade through it instead? (4) what is the mass that gets transferred from one particle to another? And (5) why cannot the mass be separated from a particle? It is difficult to assess how satisfactory the answers to these questions would be from the particle physicists. The Vedic Cosmology would answer these questions uniquely, but a particle physicist may not find them satisfactory.

The Creator energy-field according to the theistic Vedas is all-pervading with consciousness as its additional virtue. It has *Eekshana* (will-power) with the *Munn* as its operator which permeates all to affect all matter. When the creation moment comes and the Creator-entity triggers the *Asata* matter, the Creator's *Munn* pervading all the fundamental particles imparts mass and all other properties that are needed to form the universe.

Because the *Munn* pervades through each particle the imparted mass also pervades through each particle. Therefore even if a fundamental particle is further broken into pieces, each piece would have mass in it.

In the Vedic perspective, as this author has understood it, the source of the properties including mass in matter is not a pure physics process as in Higgs mechanism, but it is owing to the matter-consciousness (Nature-*Munn*) interaction under the *ritam* laws. This is why a physicist will not be able to extract mass out of a piece of matter. The other questions of equal importance are – how does an electron get one negative charge on it and can a physicist strip that negative charge off from an electron? The Vedic answer to these questions is the same as for the property of mass. The Vedic premise takes care of most of the above questions.

Even if a fundamental particle has the property of mass, it need not have the property of mass-mass attraction (gravitation). Therefore it is difficult to answer the fundamental question as to why there is mass in matter in the first place? It is understood well that if there was no mass in matter there would not be a universe! But there is a universe. So the question is – why is there a universe in the first place? In the Vedic perspective this question cannot be answered by the physics laws alone that come under *satyam* (relating to the physical realm), because the question – why is there a universe in the first place comes under the Vedic *ritam* system encompassing answers on matter-consciousness relationship.

Thus, as soon as the all-pervading Creator's all-pervading *Munn* imparts the property of mass to the fundamental *aapah* particles in the *Asata*-state of matter, all *aapah* instantly begin to experience gravitational attraction. This attraction follows the pre-ordained perfect law of gravity without the law needing any time-dependent evolution or improvement. The same argument holds for the other properties and laws of Nature, such as the creation of electrons with a negative charge, the property of motion in matter and so on. In the absence of a convincing explanation from modern cosmology/physics as to why all of Nature's laws begin with perfection and why all forces are different, independent, specific and exact to have come about without going through the process of evolution, the Vedic premise begins to sound interesting.

Let us conclude this section with a question for a physicist – why does each of the four forces in physics (discussed in Chapter 2) follow its own *dharma*, doing what it is for, without attacking the others?

# Indra-devata - the Electricity

From modern physics we learn that in addition to mass in matter the electricity is another important property of matter. Electron, the matter particle weighing $9.1 \times 10^{-31}$ kg with a negative unit charge is its carrier. The matter in its normal state is charge neutral. When an electron is taken out of a neutral piece of matter, the remaining matter gets positively charged with one unit charge. Just as two objects owing to mass in them have gravitational attraction, two oppositely charged objects also have attraction between them. On the other hand two objects with similar charge repel each other. The smallest atom, a Hydrogen atom, is electrically neutral because a negatively charged electron orbits around its positively charged nucleus (proton). Bigger atoms are also electrically neutral because the number of electrons in them is the same as the number of protons in their nucleus. There are no atoms of elements in the *Asata*-state, no electrons, no positively charged protons or neutrons. The charge separation in matter is matter's property that appears in the *Sata*-state of creation.

The property of electrons (electricity), ubiquitously present through the matter of the universe, is addressed in the Vedic physics as the '*Indra-devata*'. The *Indra-devata* (electricity) is addressed in different Vedic expressions such as *indragni* and *vaidyutagni*. The term *indragni* means "*indra that is agni"*. It also means - "*the indra having the property of agni*", where *agni* means 'energy'. The term *vaidyutagni* is a conjugation of two words, *vidyut* meaning electricity and *agni* meaning energy. Another Vedic adjective used for *Indra-devata*, is *indravaayu*, meaning the *indra* having the property of *vaayu* where the *yaugik* root meaning of *vaayu* is the force behind motion in an object. The straightforward meaning of the term *indra-vaayu* is – *the electricity having the property of motion*. As we know today, *vaayu* or motion is inherent in an electron because no one has observed a stationary electron. It is the flow of electrons in a conductor that creates usable energy. It is mind-boggling that the *rishis* of the Vedas, millennia ago, should have addressed *Indra-devata* (electricity) with the adjective of *vaidyutagni*, the "electricity as energy" and *indravaayu* the "electricity that is in motion".

Because the property of electricity in matter including the charge separation forming the atoms is to last through the creation, the *Indra-*

*devata* (an inert entity) is a primary *devata* taking part in the creation of the universe. Because the property of electricity is also a major participant in the creation of the universe where electrons are the main ingredient, the *Indra-devata* in Vedic expression is also synonymous with electrons and electricity and all those phenomena that result from electricity – lightning in thunder is one example.

## $\mathbf{E_{e\text{-}m}}$ and the Atheistic Perspective

The universe as a matter-only phenomenon, without localized or all-pervading consciousness in it, is the atheistic perspective of the Big Bang Hypothesis. In this perspective the advent of the universe is an accident in a dimensionless (nonexistent) "space-time singularity" that creates the entire matter of the universe, $10^{60}$ kg, "out of nothing" and then throws that matter far and wide filling the universe. In the Vedic perspective an extrinsic all-pervading energy $\mathbf{E_{e\text{-}m}}$ triggers the initiation of the universe in the pre-existing causal-matter, prepares it over a period of 4.32 MY by developing heat energy and rotation in it, bringing the brilliantly hot primordial (*Hiranmayamaadam*) matter conglomerate critically to the point of explosion that throws the matter far and wide filling the entire universe. In the atheistic perspective the questionable entities of the Vedic Scenario would be the preexisting all-pervading energy $\mathbf{E_{e\text{-}m}}$ and the pre-existing material-cause (Nature) of the universe. In the modern cosmology the questionable entities are the dimensionless "space-time singularity" creating the entire universe "out of nothing", Cosmic Inflation and the Dark Energy. If the "universe out of nothing" from the modern Big Bang is put aside and the Creator energy $\mathbf{E_{e\text{-}m}}$ from the Vedic Big Bang is put aside, the two cosmology scenarios have several similarities. Therefore, there is merit in giving due consideration to the Vedic Creation Scenario, because it is filled with unique thoughts and mind-boggling science principles laid down millennia ago that arouse intense curiosity.

The theistic argument for the existence of the all-pervading *Eekshana-Munn* energy $\mathbf{E_{e\text{-}m}}$ of the Creator is derived from what is ubiquitous on the Earth and now possibly in exoplanets: the *Eekshana-Munn* energy in all conscious-beings. A mass-less, formless thought in the mind (*munn*) of a conscious-being alters matter in his physical body and is transformed into mechanical action to create a well-defined tangible object. If consciousness

could exist discretized it could also happen conterminously. The Vedic perspective extrapolates this reality to the inert universe and the all-pervading conscious-being Creator, who affects the "chemistry" of the entire universe reaching inside the last fundamental particle.

In this author's understanding of the Veda mantras and the *sutras* of the Vedic philosophies, the *Eekshana* and *Munn* of the Creator are real metaphysical entities that pervade the universe like the other physical energy fields. The *eekshana* and *munn* in a living-being are harvested by the living-being from the Creator's all-pervading *Eekshana* and *Munn* fields. How enriching is the yield of this harvest to an individual conscious-being (quantum of consciousness) depends on the degree of ability to acquire *eekshana* and *munn* by the individual conscious-being. It is non-discriminatory because this degree of ability relates to the level of evolution of the consciousness in the conscious-being; the spiritual evolution and not the biological (Darwinian) evolution. The *eekshana* and *munn* of an individual conscious-being are unique to the conscious-being and are limited to his area of influence. The individualized *eekshana* and *munn* of a conscious-being are the spiritual energies. Therefore, one could put them in the category of metaphysics. Since the Vedic Creator does not have limbs and senses in the same way as living-beings do, the physical effect of the all-pervading Creator's *Eekshana* and *Munn* are the instantaneous initiation of the creation; the instantaneity being a common factor with the modern Big Bang Hypothesis wherein the newly created matter turns into a soup of quarks in $10^{-32}$ seconds of the birth of the universe. The fact that the ancient *rishis* emphasized instantaneity in the onset of the universe is by itself remarkable.

The difference between the Big Bang Hypothesis and the Vedic Principle is in the details of the processes and the terminology. Among the many differences between the two, the major difference is in the initial size and temperature of the universe. The primordial matter in the Vedic Principle is confined in finite Space at zero temperature. Then it is brilliantly hot developing heat energy $\mathbf{E_h}$. Therefore, if one viewed the Vedic Creation Scenario from $\mathbf{E_h}$ onwards, it does not matter whether the perspective is atheistic or theistic because from thereon the perspective is physics. If the Creator is dropped from the Veda mantras on cosmology, the leftover physics will make the reader wonder how the Vedic *rishis* came up with such brilliant thoughts so long ago!

In the cause-effect equation of the Vedic Creation Scenario the indefinable *Asata*-state **A** of the primordial Nature in Figure 7.1 is the 'causal state' of *Prakriti* and its 'effect' is the *Sata*-state **S** and in the next step the *Sata*-state is the cause and the universe is the effect. Once the fundamental properties are created in the matter by $\mathbf{E_{e\text{-}m}}$, the *Aditi* (Nature) is ready to take the next step. The moment of creating its first seven of the eight progeny, the *devas*, has arrived. As mentioned earlier the RigVeda mantra (10/82/6) stated, *"In the beginning,* ***all devas*** *and the* ***cosmos*** *exist in togetherness as the* ***aapah****…*" in the form of the fundamental particles of matter, all "*…concentrated in the navel (centre) of the Creator…*" until the time has come to recreate the *devas* for the present creation.

Just as the foundation of a building is first set before the rest of the building is constructed on it, the momentum in *Aditi* is to create new entities and physical systems to serve as the foundation of the universe. Since the *Aditi* can create these out of itself they all are inert matter-formations that would be both, substantive and observable as well as non-substantive and non-observable; the latter however, capable of creating observable effects. They all are part of the universe itself. Based on Vedic references these new creations will now be discussed and their relationship to the frame-work of contemporary physics will be explored.

The *devas* are the properties and energy fields that are to be created before the rest of the matter is created. According to the Vedic premise nothing can come into existence and continue to be in existence without the *devas*. This implies that before the usable matter is created the laws of creation and the *devas* have to be in place first. This step in the creation is therefore termed as the "first action of *Aditi* (Nature)".

# CHAPTER 8: First Action of Aditi (Nature) – the Creation of the Eight Progeny of Aditi

The first creations of *Aditi* (Nature) are known in the Veda as '*Ashthau Aditi-putraha*'. This means "*Eight Progeny of Aditi*". Nine mantras of the 72nd *sukta* of the 10th *mandal* of RigVeda (10/72/1-9) are devoted to the subject of *Aditi*'s eight progeny. The *rishi* of this *sukta* is Brihaspatir-brihaspatirva Laukya Aditirva Dakshayani. The Vedic term *Prakriti* for the Nature-entity was defined in Chapter 5 under the sub-heading "**The Nature-entity (*Prakriti-tatva*)**". The root meaning of the term *Aditi* for Nature was also defined - that it is ***'the entity for utilization' or 'the entity for consumption'*** because the Nature is utilized in creating the universe and the creation is for utilization. It is utilized in creating both realms of the creation - inanimate and animate (cosmos and living-beings).

Before the living beings appear in the well-established creation, before the life-system with roots appears, before the cosmos are formed and even before the Big Bang in the primordial *Hiranya-aand* (Golden-embryo) occurs, the *Aditi*'s first action takes place. *Aditi* creates the **seven** *deva*-energy fields from half the matter of the universe and **one** *Maartaand* (Mortal-ovate) from the other half. These first 8 creations of *Aditi* (Nature) are addressed as the '*Ashthau Aditi-putraha*' (Eight Progeny of Aditi). The first seven of these eight progeny, known as the *devas*, are ubiquitous subtle energy fields of Nature that would last till the end of the creation. They represent the fundamental properties of matter that are essential in enabling the *srishti* (creation) and its sustenance in both the realms - inanimate and animate. The eighth progeny of *Aditi* (Nature) termed as the *Maart-aand* (Mortal-ovate), is the raw material for the formation of the observable cosmos.

Although within the range of instantaneity the creation of the *devas* is a major step in the Vedic creation. This author has labeled the creation of the seven *devas* as the Step-2 in the development of the Vedic Big Bang Scenario (Step-1 presented in Chapter 7). In the conceived Step-2 of the scenario the matter transits from the indefinable to the definable state giving rise to the swelling of the primordial matter (Nature) from *tuchchhaya* (diminutive) to colossal, as shown symbolically in Figure 7.1.

Speaking metaphorically, just as sugar, a visible substance, cannot be separated from its invisible property of sweetness, the *devas* are the basic properties of the matter of the universe that are essential for the creation and the sustenance of the universe. The extreme subtlety of the *devas* make them invisible and only through their interaction with matter do they become discernible. The *devas* being ubiquitous they function in the physical as well as in the metaphysical realms. The seven *devas* are further discussed in this chapter and finally listed towards the end of the chapter. To gain a bit of insight into the *devas* let us take the example of one of the *devas*, the *Indra-devata*. The *Indra-devata* is the property of electricity in Nature. *Indra-devata*'s carrier is the electron. An electron has a negative charge that a physicist cannot remove from it or put back on it. All electrons inside an atom are revolving non-stop around its nucleus. In the Vedic expression the *Vaayu-devata* of motion (inherent property of motion) is driving it non-stop. A physicist cannot bring an electron to zero velocity.

What is the property of mass in matter? Why does mass create gravitational attraction between two masses? All such properties, not creatable by humans, do exist in Nature and are credited in the Vedic thought to an all-pervading energy field that preexists the onset of the universe. This author calls it the Creator's *Eekshana-Munn* energy and denotes it by the letter $\mathbf{E_{e\text{-}m}}$. After this energy has completed its mission, all physics laws (Nature's laws) get activated advance the creation of the universe.

Symbolically, the 7 *deva*-fields are shown in Figure 8.1 with differing colours and the $8^{th}$ progeny named *Maartaand* is shown as a black spheroid in the centre, immersed in the *deva*-fields.

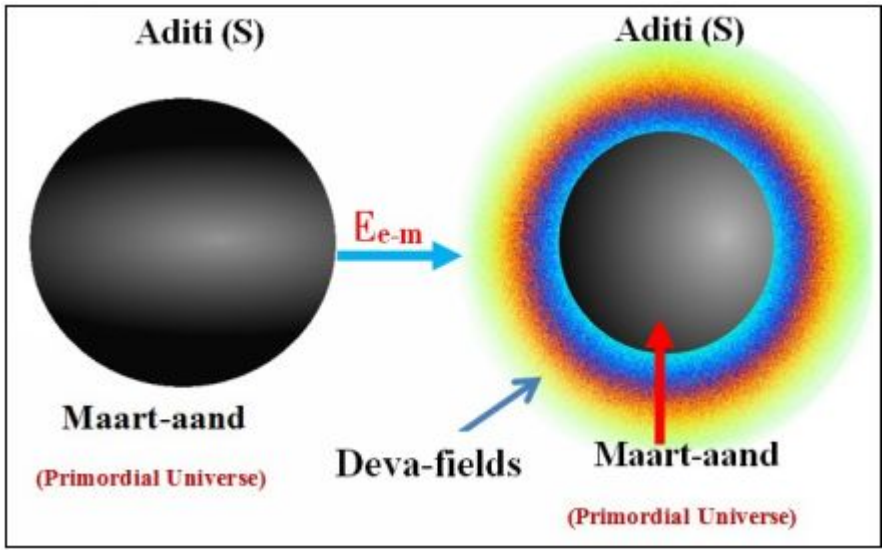


**Figure 8.1:** *Mahat-aand* (Great-Ovate, *Sata*-state)(Left). Energized by $\mathbf{E_{e-m}}$**.** (Right). Separation of 7 *deva* fields (outer spheres) and 8th progeny of *Aditi* the *Maart-aand* (Mortal-Ovate) the inner black-spheroid. All is *Aditi*.

*Maartaand* the Mortal-ovate is the subject of the 8th and 9th mantras of the 72nd *sukta*. This *sukta* is presented in the following in its entirety. It is the *Maartaand*, the 8th progeny of *Aditi* that serves as the primordial matter of the universe and used up in creating all observable cosmos. To understand this cosmic mystery hidden in the mantras let us first invoke the *Deva Sukta* of the RigVeda.

In the chain of creation of the universe, just as the *Bhavavrittam sukta* of RigVeda described the fundamental state of the universe transiting from *Asata*-state to *Sata*-state, the *Deva sukta* (10/72) of RigVeda presents a transition from *Prakriti* (Nature) in its indefinable state of matter to *Aditi* (Nature) in its definable state of matter. This intermediate stage of Nature is not the Vedic Big Bang yet. The 7 created progeny have non-perishable *devic* properties but the eighth child named *Maartaand*, as the name suggests, is a three-dimensional ovate with the property of transience, change and death.

When the meaning of the term *deva* or *devata* was discussed in Chapter 4 it was pointed out that Max Mueller and the other Western Sanskritists had misunderstood the term and mistranslated it to mean multitudes of ‘gods and goddesses’. The ancient book of Nirukt (7/1,

7/4/15) states that '*devata is a general term applied to those substances and functions whose attributes are explained in a mantra*'. The attributes of *devata* include - '*possessing brilliant qualities and deemed essential for the sustenance of a certain aspect of the creation'* and *'possessing virtue of selflessness'*, '*existence with selflessness, possessing brilliance, illuminator of other* substances *and resident of the brilliant region of the universe*'. All italicized text is drawn from the Veda mantras. The properties of *devatas* presented in the book of Nirukt point to the fact that the *deva* adjective is applicable to both realms - the animate and the inanimate. The seven specific *devas* of this *sukta* are all inert physical systems of Nature.

Immediate derivations of other words from the term *deva* are: *devata, devah, devic, daivic* and *daivata,* representing specific grammatical usage in a given context. There are other entities in the creation that possess *devic* virtues of selflessness, having existence for the benefit of the others. They are addressed as the *devas* as well as the *rishis*. In addition to the seven specific *devas* there are 33 other major *devatas* named in the Vedas that emerge out of the *Maartaand* after the primary creation of the universe is established. They are essential for the sustenance of both, the living and the inert creations throughout the life of the universe and are essential in particular on the Earth and other terrestrial planets in the universe for sustaining life. The Earth itself a secondary *devata* among 33, provides selfless service to living beings and the Sun, another secondary devata, shines selflessly for the benefit of the others. However, the first creation of nature comprises the seven primary *devas* before matter appears. These 8 progeny of *Aditi* are not separate from *Aditi*; they are part of *Aditi*. In other words, the Nature creates its own children consuming itself in creating them.

The enumeration of these *devic* entities of the early creation is not rendered in the mantras in a straight forward and ordinary fashion. The mantras on *devas* have poetic adornments expressing the grandeur of the first creations of Nature. For example the onset of dynamics in the quanta of matter is depicted with descriptive expressions such as '*their cosmic dance*' and '*their dynamic dance*' leading them to congregate into the '*great objects of the cosmos*' filling the vast space of the universe with abundant refulgence.

The first mantra of the *Deva sukta* is,

देवानां नु वयं जाना प्र वोचम विपन्यया ।
उक्थेषु शस्यमानेषु य: पश्यादुत्तरे युगे a ॥

(RigVeda, 10/72/1)

**Transliteration:**

**"***Devaanaam nu vayam jaanaa pra vocham vipanyayaa* ।*Uktheshu Shasyamaaneshu yah pashyaaduttare yuge* ॥"

**Word translation**: (Instead of sequentially listing the words of the mantra as has been generally done so far, the words of this mantra are presented in an order used in the sentence construction in English.)

वयं नु प्र वोचम (*vayam nu pra-vocham*) = this we are stating with emphasis, विपन्यया (*vipanyayaa*) = with clarity in voice, जाना (*jaanaa*) = of the birth, य: (*yah*) = the group of, देवानां (*devaanaam*) = Nature's creation of entities with brilliant properties that help sustain creation, उक्थेषु शस्यमानेषु (*uktheshu shasyamaaneshu*) = expressed in this mantra, पश्यात् (*pashyaat*) = observable or to reveal their presence, उत्तरे युगे a ( *uttare yuge*) = in subsequent *yuga* time epochs in the creation or for the rest of the creation period.

**Mantra Translation:**

*"This we are stating with emphasis and clarity in voice (mantra) for the birth of the group of devas; the Nature's creation of the entities with brilliant properties that help sustain the creation. Let it be known that once created devas will continue to be observed through all time epochs of subsequent yugas of the creation."* (RigVeda, 10/72/1)

**Mantra Interpretation**

This mantra sounds like a joint proclamation issued by the scholarly people. However, this is just one of the styles in the Vedas, quite similar to the practice we have today where an expression in singularity is presented in plurality. The term उत्तरे युगेa (*uttare yuge*) for 'subsequent *yuga* periods' is important. It was discussed in Chapter 5 that the total age of the Vedic creation is 1,000 *deva-yuga* periods with each *deva-yuga* period being 4.32 million years. Created once the *devas* are to continue being observed for the subsequent *yugas*. This means that they continue to function for the rest of the life of the creation. The mantra's emphasis is that the humans may have short life but their *brothers-in-immortality*, the inert *deva*-systems *possessing brilliant qualities* remain ubiquitous and last through the universe's life (serving selflessly).

An example of a *deva* is the ubiquitous *aapah* (fundamental matter particles in triplet) with the property of gravitation owing to mass in them, the property that permeates all, holding the universe together and will last till the end of the universe. It will last till the end of the universe because the property of mass in matter will last till the end of the universe.

For the sake of brevity now we will present the next six mantras with composite translation without a detailed word meaning. The important words of the mantra however are superscripted and interpreted.

ब्रह्मण[1]स्पतिरेता सं कर्मार[2]इवा[3]धमत्[4] ।
देवानां पूर्व्ये युगेb ऽ सत:[5] सद[6]जायत ॥

(RigVeda, 10/72/2)

**Transliteration**:

"*Brahmna[1]spatiretaa san karmaar[2]-iva[3]-aadhamat[4] । Devaanaam poorvye yuge[b]- asatah[6] sadjaayat[7]* ॥"

**Mantra Translation:**

*"In the beginning yuga*b *(period) of creation, Brahmn[1] the Master of the universe, created devas like[3] a karmaar[2] (blacksmith, artisan) creates definite objects by pumping[4] energy. This is when the matter of the universe transited out of*

*the Asata*[5]*-state (causal, of non-being) into the Sata*[6]*-state (of being).”* (RigVeda, 10/72/2).

Notice the usage of the terms *Asata* and *Sata*, same as in *Bhavavrittam sukta* of RigVeda, presented in Chapter 6. A detailed discussion on the two states of matter, *Asata*[5] (the inactive indefinable static state) and the *Sata*[6] (matter in existence) was presented there. The relationship between the ‘Efficient-Cause’ the Creator and the ‘Material-Cause’ the Nature, is a common theme in the Vedas. The *rishi* of the mantra expresses the physical process with a specific poetic adornment and simile called *alankaar* which enables deep thoughts brought to the level of a reader’s understanding. *Brahmn*[1] the Creator in this mantra is presented in a similitude of a blacksmith[2] (or an artisan) pumping[4] heat energy into the raw material of the object that he creates. In the context of the *sukta* the raw material is the Nature, which is the material-cause of the universe in *Asata*-state. As mentioned a number of times, the usage of a single word or a single syllable in the Vedic Sanskrit is not casual or unintentional. The same is true for the usage of the term *karmaar*[2] for the Creator in the mantra. A *karmaar*[2] (blacksmith) pumps energy to heat the raw material to create a desired object. The perfection of this simile is remarkable because no blacksmith begins pumping heat energy into the raw material without his *eekshana* with “*visualization, thought* and *desire to create tangible things”*. The primary energy that a *karmaar* pumps into the raw material is extrinsic to the raw material as was discussed in the Vedic Cosmology Principle in Chapter 6. This Vedic thought is concurred by another mantra.

The term *karmaar* can also be used for an artisan or a sculptor. Even today, a sculptor with a desire (eekshana) and a plan in his mind (*munn*) starts with an unshapely, undefined raw material to create a definable object. The preexistence of the raw material is an essential condition for any creation big or small. A *karmaar* does not create his art ‘out of nothing’. The *karmaar* does not create a piece of his art out of himself either. It is often said under Quantum Mechanics that the matter anti-matter particles appear ‘out of nothing’ and disappear into nothing. In the modern Big Bang however, the matter and anti-matter are said to have appeared simultaneously but all matter did not disappear into nothing but still continues in the form of the universe and only the corresponding anti-matter disappeared into nothing, or it could still be somewhere.

*Karmaar*, the Creator in this mantra, आधमत्[4] (*aadhamat*), pumps the creation energy $E_{e\text{-}m}$ into the primordial matter of the universe which appears as the heat energy $E_h$. The Creator being an all-pervading force also has the all-pervading *Eekshana*-energy that penetrated into each fundamental particle. The $E_{e\text{-}m}$ of the Creator energized each fundamental *aapah* particle of the primordial matter shown symbolically as the increased volume of the primordial matter of the universe in Figure 7.1. The next action of the Creator is to create 7 devas having the virtue of immortality through the creation and the 8th conception, the Maartaand, having the property of transience and death. The *deva* fields and the *Maartaand* are symbolically depicted in Figure 8.1.

Based on the mantras it is discussed later that the apportionment of mass between the *devas* and the rest of the universe is half-half. Therefore the size of the black spheroid of matter in Figure 7.1 was shown reduced after creating the *devas* in Figure 8.1. To have the mass reduced to half, the spheroid's diameter was symbolically reduced by a factor of about 0.8 (right side of Figure 8.1).

Even though all *devas* permeate through each other and through the universe, symbolically the 7 devas in Figure 8.1 are shown as the concentric spheres. They all extend to the edge of the universe. The creation of the 7 devas stretches the Space-entity to create space for all objects of the universe to be born. The eighth progeny of *Aditi*, the *Maartaand*, is shown as the reduced black sphere at the centre.

The term पूर्व्ये युगेb (*poorvye yuge*) places a time-marker on the creation period of the *devas*. The straight forward meaning of पूर्व्ये युगेb (*poorvye yuge*) being 'in the first yuga period', states that all seven devas were created and established in the first-yuga[b] period of the creation. The Shatpath Brahmana statement (11/1/6/1, 2) to be presented under the Step-3 also refers to the one *deva-yuga* that the *Hiranyam-aand* (Golden-embryo) floated in rotary motion before the Creator broke it into "millions upon millions" of smaller ovates.

The next mantra presents a broad sequence of the creation of systems putting a significant time-stamp on a specific epoch of creation.

देवानां युगे प्रथमेcऽ सत: सदजायत ।

तदाशा अन्वजयन्त तदुत्तानपदस्परि ॥ (RigVeda, 10/72/3)

**Transliteration:** "Devanaam yuge prathmec asatah sadjaayat । *Tadaasha anvjayant taduttaanpaadaspari* ॥"

**Mantra Translation**

"*The matter transits from Asata to Sata state in the first-yuga[c] (period) of the devas and then the directions become perceptible all around. Only after that begins to appear in the creation the uttaanpaadah the living-matter with root system (vegetation).*" (RigVeda, 10/72/3).

All three mantras of the "*Devah sukta*" with the usage of the term युग (*yuga*) have revealed the relationship of the creation of the universe to a specific time-period. Considerable discussion on the Time-entity was presented in Chapter 5 where the terms, *deva-yuga, maha-yuga, chatur-yugi* and the specific names of the four *yugas* forming a *chatur-yugi*, were elaborated upon with their numerical values. The fifth row of the Table 5.3 in Chapter 5 establishes the relationship between a *deva-yuga* and the human years. With regard to the usage of the term *yuga* in the above three mantras, the prefix-adjective or the suffix-adjective to the noun युग (*yuga*) reveals which specific *yuga* period is being referred to in the mantra. This leads to the contextual mathematical meaning of the term *yuga*. A *deva-yuga* or *devic-yuga* was defined in terms of the Vedic time-measurement period (Chapter 5) to be the same as a *Maha-yuga*, which is also the same as one *Chatur-yugi* equaling 4,320,000 Earth-years (4.32 MY).

The terms that represent time-periods have appeared in differing expressions in the above three mantras. With the prefix-adjective or the suffix-adjective they respectively are: (a) उत्तरे युगे[a] (*uttare-yuge* in the first mantra of RigVeda (10/72/1) means '*in subsequent time epochs in the creation*', (b) पूर्व्ये युगे [b] (*poorvye-yuge*, in the second mantra of RigVeda (10/72/2) means '*in the beginning yuga of the creation'* and (c) युगे प्रथमे[c] (*yuge-prathame*, in the third mantra of RigVeda (10/72/3) means '*in the first yuga of creation*'. What one observes from these three mantras with *yuga* references in them is that the Veda is placing the definite time markers on

the creation history. The time-marker in all three mantras is the first *yuga* when the seven devas are created from the *Aditi* (Nature).

These time-markers addressed the most fundamental query of the inquisitive human mind - is the whole creation ever-persisting or did it begin at a given point in time? When the Veda emphasizes on what was created in the first *yuga,* it becomes clear that this universe had a definite beginning. With respect to the local frame of reference, these mantras also answer the common question - did the Earth, Sun, Moon, cosmos, directions and living-beings always exist or did they appear in this creation subsequently in different time-epochs? The answer from the mantras is that this creation had a beginning and other phenomena in it also had a beginning at different points in time. It is obvious from these three mantras that there is a certain degree of clarity in the Vedic Cosmology. The defined *yuga* period of 4.32 MY years for the first step in the creation is an extraordinary statement in the Veda mantras.

The third mantra states that after the matter transits from *Asata*-state to *Sata*-state at the time-zero of this creation, the inert *devas* are created first, then cosmos emerge, then the directions stabilize and only after that the first living-beings appear in the form of vegetation system.

It may not be consistent with the modern Big Bang Hypothesis or the modern hypotheses in biology but the Vedic Cosmology here lays down a remarkable rule that it took first 4.32 MY of the onset of the Vedic creation to stabilize the directions on the Earth, meaning the solar system is stabilized, when the first living creation appeared in the universe and on the Earth. This living creation according to the Vedic premise is the *uttaanpaadah* (vegetation); not animals, not humans! The difference may be in the timeline; however, this Vedic deduction is no different from what modern science would tell us. This Vedic rule means that it takes 4.32 MY from the onset of the creation to form the Earth and for the Earth to become suitable for giving birth to the vegetation world. Life being a ubiquitous and generative phenomenon, the same could be said for all those *paroksh* (far away beyond observation) exo-planets in other solar systems. This is a time-marker set in Vedic Cosmology eons before modern science took birth.

One needs a planet like Earth with essential substances on it to enable intelligent life-forms like humans, who are capable of developing analytical thought, to have the realization of their own existence and the existence of matter and energy all around in the universe in both realms – animate and

inanimate. The two following mantras address the query of the human mind – "what appears after what" in this creation. Then the *rishi* of this RigVeda *sukta* returns to the subject of cosmology.

भू[1]र्जज्ञ उत्तानपदो[2] भुव आशा[3] अजायन्त ।
अदिते[4]र्दक्षो[5] अजायत दक्षा[5]द्वदितिः[4] परी ॥
(RigVeda 10/72/4)

**Transliteration**:

"*Bhoo*[1]*rjyagya uttaanpado*[2] *bhuva aashaa*[3] *ajaayanta /Adite*[4]*rdaksho*[5] *ajaayat daksha*[5]*adv-aditihi*[4] *pari* ॥"

**Mantra Translation:**

*"The directions*[3] *are established and the uttaanpadah*[2]*, the vegetation-creation, is revealed on Earth*[1]*. Then from the (inert) Aditi*4 *(Nature) are revealed dakshah*5 *(humans) and in reciprocation the Aditi*4 *(Nature) is revealed back by humans*5*."* (RigVeda, 10/72/4).

This RigVeda mantra (10/72/4) is for the emphasis and continuity of what was established in the previous mantra. The translation of this mantra is self-explanatory; just a few comments should suffice. It reemphasizes that the living creation in Vedic Cosmology begins after the inert *devas* are created. It is the vegetation among the living creation that appears first and then living 'beings with body' come into existence. The term *dakshah*[4] stands for "*a logical thinking smart human-being"*. Therefore, humans appear on Earth after the vegetation appears and the directions are established. The directions in Vedic thinking are a real entity and the knowledge of directions is important because without a reference frame (directions) any pursuit of knowledge would not yield results (discussion in Chapter 5). This implies that humans are revealed by Nature well after there is order in the universe in all directions and in particular on the Earth.

The usage of the term *Aditi*[4] in this mantra is not casual; rather it is contemplative because this state of Nature relates to its utility in creating things. The *Aditi* is being consumed not only for creating the *deva* fields and the cosmos of the observable and unobservable universe; it is also

being utilized to form the substantive bodies (*sthool sharer*) of the living beings.

In the next mantra, the conscious-being is addressed to become cognizant of the fact that the very existence of a living-being is dependent on *Aditi*.

अदिति4र्ह्यजनिष्ट दक्ष5 या दुहिता6 तव ।
तां देवा7 अन्वजायन्त भद्रा8 अमृत9बन्धव:10 ॥(RigVeda, 10/72/5).

**Transliteration:**

"Aditirya4-janishta daksha5 yaa duhitaa6 tavTaam deva7 anvajaayanta bhadraa8 amrit9- bandhavh 10॥"

**Mantra Translation:**

*"O daksh*5 *(conscious-being) when the Aditi*4 *(Nature) comes into existence as duhita*6*, your nurturer, the devas*7 *are revealed to you that remain the providers of your well-being*8*. These life-supporting devas are your amrit*9*-bandhava*10 *the brothers*10*- in-immortality*9*".* ( RigVeda, 10/72/5).

This mantra needs further interpretation. The term *duhita*6 stands for one who suckles with affection, providing essential nourishment for the suckling. Mother is a *duhita* because she feeds her milk through her breasts. A cow is a *duhita* because she suckles the calf and gives milk for the benefit of humans. The adjective of *duhita*6 is used for *Aditi*4 because Nature is the source of nourishment for all aspects of creation and in particular for a conscious-being (*daksh*5) who utilizes *Aditi*'s bounty that comes in diverse forms. The Nature's systems such as the *devas* and the other forms of energy and matter that sustain the living and inert creation are *Aditi*'s bounty. The primary nourishment from *Aditi*4 to a conscious-being is the conscious-being taking matter out of it in three states of matter (solid, liquid, gas) and utilize subtle forces and energies to form the living physical body. It is the physical body of a living-being (soul) that enables all karma and all actions necessary for survival, living and its spiritual evolutiom to

the next level. A *daksh*5 derives pleasure by being born in Nature and by imbibing *Aditi*4 like an infant feels pleasure by sucking from the mother's breast. Nothing is possible without utilizing the Nature, including the attempt to find the answer to the age-old question - 'how did the cosmos come to be'?

Rishi Kapil probability based his Saankhya Darshan *sutra* (3/58) on this mantra with an added simile. His formulation reads thus:

*प्रधानसृष्टिः परार्थं स्वतोऽप्यभोक्तृत्वात् उष्ट्रकुङ्कुमवहनवत्।*

(Saankhya Darshan, 3/58)

**Transliteration:**

"Pradhaan-srishtih paraartham svato-api-abhoktri vat, ushtra-kumkum-vahanvat"

**Sutra Translation:**

> *"The Nature-procreated universe is solely for the benefit of the soul (quantum of consciousness) because the Nature by itself is not a consumer as in the case of the saffron-hauling camel". (Saankhya Darshan, 3/58)*

Saffron is a valuable commodity for someone else but it is of no interest or value to the camel that passively hauls it from one place to another. The inert Nature in Rishi Kapil's simile is an uninvolved entity of this creation. It presents itself to be utilized by others. A mother does not utilize her milk for her own use. The other intellectual benefit from the *sutra* in Saankhya Philosophy is the clear message that Nature has no initiative of its own to carry out any intentioned action to create the universe.

While expounding his philosophical thought Rishi Kapil states in his next *sutra* (3/59) that-

> *"The Nature inspite of being an inert entity has a tendency in it like the active milk-flow (in the breast of a feeding mother)*". Saankhya Darshan (3/59)

Milk, an inert substance, exhibits the action of flow when a mother suckles the infant. When an infant desires milk and the mother instinctively provides it, the inert milk develops the action of flow in the mother's breast.

This may lead one to think that the milk is a living-substance and flows with purpose. Like milk, the inert Nature as a whole is observed exhibiting action and is available for utilization by the conscious-being *daksh*. Rishi Kapil through the *sutra* therefore warns the reader not to get confused with an observed action in inert substances to mean that the inert substances create action with purpose. Many tendencies in Nature may give an impression that the Nature is a living-entity with desire and purpose, but as in Rishi Kapil's example, it has no more purpose than a camel hauling saffron for which the camel has no value. At the same time one is not to think that the owner of the camel has no purpose in hauling the saffron.

A large number of other mantras, *suktas* and the entire Vedic Philosophy for that matter expounded by Rishi Kapil and the other great *rishis*, propound that the process of creation of the universe has a definite purpose, but the inert Nature by itself has no purpose of its own and it is only for utilization. In modern cosmology also the Nature as a dimensionless singularity or as a lump of matter or in the form of an effulgent universe, is without purpose. The utilization of Nature for forming the material bodies by living-matter (consciousness) is also seen as a purposeless exercise. This purposelessness stems out of the basic premise of modern cosmology that the advent of the universe is a strange happening, an accident, at a dimensionless point in space and time when the right circumstances just fell into place. All laws of Nature and physical variables also came together fortuitously. Owing to these seemingly improbable coincidences the Anthropic Principle (discussed briefly in Chapter 2) cannot have a respectable place in modern cosmology. The material and consciousness aspects of the Anthropic Principle in modern cosmology are the subject matter of another book by this author.

Just as *duhita*6 is an adjective for *Aditi*, another beautiful adjective in the same mantra is *amrit*9-*bandhava*10 for the *devas*7. Through these adjectives is established the Vedic anthropic relationship between matter and consciousness. The term *amrit*9 means '*one that does not die*' and the plural word *bandhava*10 means '*brothers*'. The seven inert *devas*, the first creation of Nature, are said to be the brothers of दक्ष5 (*daksha*) the conscious soul. A brother is the one who protects a brother and lives in that relationship till death. A soul, the *daksh* of the mantra, is an eternal entity by its nature which becomes active to do karma during the creation phase of Nature. *Devas*, the specific subtle properties of Nature, that are created right

in the beginning of the universe, though inert in nature, remain in bond with the soul through soul's body during its rebirth cycle right through the creation. This is why the adjective *amrit*9-*bandhava*10 is used for the *devas*7, which means *brothers*10-*in-immortality*9. After the death of a physical body the matter of the body is left behind for 'dust unto dust', however, the bonded *deva* forces remain part of the soul's "subtle-body", the metaphysical body, termed in Kapil philosophy as the '*sukshma-shareer*'. It is the *sukshma-shareer*, made of 13 subtle forces and ingredients at metaphysical level, including the seven devas, which function through the living physical body that carries the soul forward for the next "dance of karmas".

The relationship between the inert Nature and the consciousness (soul) is intricate and has been addressed well in the Vedas and the Vedic Philosophy. However, the difference between the 'subtle-body' formed out of the subtle forces of Nature called the *devas* and the 'substantive body' formed out of substantive matter, is an involved subject and beyond the scope of this book.

The *Deva sukta* with the next mantras brings us even closer to cosmology. They provide a glimpse into the early history of creation when the dynamics of the *devas* is delineated before the appearance of the observable matter, the cosmos.

यद्देवा[7] अद: सलिले11 सुसंरब्धा12 अतिष्ठत 13 ।
अत्रा वो नृत्यता14मिव15 तीव्रो16 रेणु17रपायत[18]॥ (RigVeda, 10/72/6)

Transliteration:

"Yaddevaa7 adah salile11 susamrabdhaa12 atishthhat13 ।
*Atraa vo nrityataa14miv15 teevro16 renu17rapaayat18* ॥"

**Mantra Translation:**

*"Beginning from Salila[11] the causal-state of Nature, the devas[7] are completely established[13] with dynamic omni-directionality[12]. In this process their renus[17], the fundamental quanta, spread*[18] *out through this universe far and wide moving vigorously[16], fast, like[15] a dancer[14]"* (RigVeda, 10/72/6).

**Mantra Interpretation**

The mantra emphasizes that the Nature for the creation process transits from its *salila-state*[11] to its *Sata*-state. This *salila-state*[11] is the same that was stated in the RigVeda mantra (10/129/3) in the *Bhavavrittam sukta* (*sukta* on the History of Creation of the Universe) discussed in Chapter 6. The mantra is clear on *devas* being created and established first, before the observable matter is created; the latter being the subject of the mantras 8, 9 presented below. Two words in the above mantra, रेणु[17] (*renu* = fundamental quanta/corpuscles) and अपायत[18] (*apaayat* = to spread far-and-wide) are of great significance. A physics statement conveyed by these terms is – the *deva* fields are quantized and are ubiquitous. The Vedic defined Nature itself is a quantized entity in *sata, raja* and *tama* at its most fundamental stage. Therefore, all creations of Nature by logic have to be quantized at their most fundamental level, so also the *deva* fields. One cannot create a continuum out of quantized bits. The term *apaayat*[18] with the term तीव्रो[16] (*teevro*[16] = fast and forceful) reveals that the early universe expanded tremendously fast.

It becomes obvious from this mantra and the mantras that were presented under the "Vedic Cosmology Principle" in Chapter 6, that the fast expansion (*vitatah*) of the early universe, before the observable matter is formed, is a common feature of the Vedic Universe and the modern Big Bang Hypothesis. The difference is that in the Vedic Principle, the minutest of all matter-forms called the *devas*, are created first and spread out stretching the Space-entity creating room for the existence of observable matter and energy when they are created. Ubiquitously present the *devas* with infinite extent through the universe are not affected or altered in their nature and magnitude. For example a water molecule (matter) could be dissociated into Hydrogen and Oxygen atoms but an electron, the fundamental रेणु[17] (*renu*) of the *Indra-devata* (the electricity), cannot be broken into smaller pieces. An electron will remain an electron till the end of the creation. This is the meaning of a *deva* remaining an *amrit-bandhava* the brother-in-immortality.

# Cosmic Dance of Aditi (Nature)

An attractive feature of this mantra is the visual it creates through a poetic simile (no religious connotations). As the *devas* are being created, their every quantum spreads and moves '*vigorously and forcefully fast*' (तीव्रो$_{16}$ = *t*ee*vra*) in an action *similar to a brisk dancer* (नृत्यता$^{14}$मिव$^{15}$ = *nrityataa–miv*). The simile of a dancer to a moving corpuscle of energy is vivifying beautiful poetry. In a dance, especially in the *shastriya* (classical) dance-form of the Aryans that originated thousands of years ago, the whirling of a dancer to an accompanying rhythmic time-cycle, is an integral part of the dance art form. Therefore, the dynamic process of the spreading of the *devas* is like the wave-quantum duality in display, the display performed on the stretching stage of the Space-entity with the fundamental matter of the nascent universe engrossed in vibration, rotation and translation. If there is a 'Cosmic Dance of the *Aditi*', this is it. The *devas* are the inherent properties of matter, observed through creation. The delineation of the *vigorous and forcefully fast* dance of fundamental particles is a physics process without any religious overtones.

If one could see at all scales of time and space, one would see the perennial dance of *Aditi* at all its levels. The dancing of *Indra-devata*'s minute representative, electron, around the nucleus of a *parmaanu* (atom), the revelation of the *Vaayu-devata* the *devata* of motion, through the dance of the wave-packets flowing on the surface of the ocean, the Earth completing its rhythmic twirl around the Sun, the Sun performing its own dance at the rhythmic cycle of 250 MY around the centre of the Milky Way Galaxy and the movement of multitudes of brilliant phenomena from micro to macro level are all part of *Aditi*'s continued dance, its नृत्यता$^{14}$मिव$^{15}$ (*nrityataa–miv*), in the created universe.

How pervasive and minute are these *devas*? Are these *devas* absent in some parts of the universe? Are they stopped by matter? The next mantra provides answers to such questions. The superscripts on the important words are restarted from the numeral one.

यद्देवा यतयो$^{1}$ यथा भुवना$^{2}$न्यपिन्वत ३ ।
अत्रा समुद्र ४ आ गूळहम ५ सूर्यम$^{6}$जभर्तन$^{7}$ ॥ (RigVeda, 10/72/7).

**Transliteration:**

*"Yaaddeva yatyo[1] yathaa bhuvna[2]nyapinvat[3] ।*
*Atraa samudra[4] aa gooldham[5] sooryam[6]ajbhartan[7] ॥"*

**Mantra Translation:**

*"Born of Nature, these dynamic[1] devas pervade[3] themselves through all objects of creation[2]. This deep[5] Space[4] is completely filled [7] with them including from non-observable minute particles to the great illuminated objects such as the brilliant Sun[6]"*. (RigVeda, 10/72/7).

The translation of the mantra is self-explanatory in that the *devas* are pervading through the entire creation ranging from minute particles to large celestial objects. Therefore, these Vedic *devas* must be the fundamental properties of matter throughout the creation, present in the interior of each atom including the sub-atomic particles. The *devas* are present through the entire Space (समुद्र[4] =*samudra*, 17th synonym of Space in Table 5.6 in Chapter 5, Volume 1) even where absence of matter is envisaged. They are established fully in Space first for the rest of the creation to begin.

It is the 8th mantra of the *Deva sukta* that gives a count of 8 for the progeny of *Aditi*; the first 7 being the *devas*. This mantra tells us about the usefulness of the *devas*, the first 7 progeny of Nature and according to the mantra the *Aditi* '*hurls her 8th child in space to great distances*'. The mantra also distinguishes between the minute form of matter/energy constituting the invisible *devas* and the substantive observable form of matter in the cosmos. This is an important mantra for this chapter, establishing the sequence in creation; its detailed translation is provided in the following.

अष्टौ पुत्रासो अदितेर्ये जातास्तन्व-स्परि ।
देवां उपप्रैत्सप्तभि: परा मार्ताण्डमास्यत् ॥

(RigVeda, 10/72/8)

**Transliteration:**

" *Ashtau putraaso aditerye jaataastanva-spari ।*

*Devaam uppraitsaptabhih paraa maartaandmaasyat ॥*"

**Word translation**:

अष्टौ (*ashtau*) = eight, पुत्रास: (*putraasah*) = progeny (*plural*), अदिते: (*aditeh*) = out of (*inert*) *Aditi* , ये (*ye*) = the ones , जाता: (*jaataah*) = born , तन्वस्परि (*tanvaspari*) = from the material of her own body ।
देवान् (*devaan*) = to or with the conscious-being *daksh* (pluralized souls), उपप्रैत् (*upprait*) = acquiesces with kinship, सप्तभि: (*saptbhih*) = with seven progeny, परा आस्यत् (*paraa aasyat*) = spreading by throwing far-and wide, मार्ताण्डम् (*maartaandam*) = (remaining eighth) mortal-ovate ॥

**Mantra Translation:**

> *"Of the eight progeny born out of the material of her own body, the Aditi with her seven progeny acquiesces in kinship with conscious-beings. The Aditi throws its eighth progeny named Maart-aand (in ovate shape), far-and-wide spreading it to great distances."* (RigVeda, 10/72/8).

Even though this author pre-empted the count of *Aditi*'s progeny to be eight from the beginning of the chapter and in particular in the discussion through the Step-2, it is this mantra that provides the count of 8 and states clearly what *Aditi* does to the 8th progeny. The progeny named *Maartaand* is counted as the eighth. Therefore, the *Maartaand* is the last progeny of *Aditi*. The first seven, the inert *deva*-creations of *Aditi*, were the subject of the previous seven mantras.

An important point in the first part of the mantra is that all eight forms of matter are created out of the material of *Aditi*'s तन्वस्परि (*tanvaspari*) – *Aditi*'s own body. The specific reference in the mantra to the Nature creating eight entities from its own body means that it is consumed in creating its eight progeny – the eight progeny are the Nature itself. The *Aditi* being inert, all eight progeny are inert entities as well.

In a common birthing process, the child is conceived in mother's womb, it grows for a definite period, the mother gives birth to it and the mother continues to exist and can give birth to more children. All children as well as the mother can co-exist in this birthing process. So that the reader does not assume that the birthing process of the universe is similar to the common birthing process, the mantra makes it clear that the birthing process in the case of *Aditi* is different, in that the mother Nature totally consumes its own body in creating its 8 progeny (the 7 *devas* and the *Maart-aand*).

The mantra further emphasizes that the Nature presents itself to the living-being souls with its first seven *deva*-creations. During that early state of Nature there were no cosmos and no astronomical bodies of terrestrial nature to support the existence of living-beings with their bodies, yet the Nature is said to present itself to the conscious-beings. The mantra also states that the seven inert *devas* are presented by the *Aditi* to *devaan* where the term *devaan* in the mantra stands for the general plural conscious-being *daksh* (souls) addressed in the fifth mantra. This relationship of *Aditi* with the conscious-being *daksh* appears throughout the Vedas and the Vedic philosophy. For example another RigVeda mantra (10/64/5) *"Dakshasya vadite..."* expressed it very beautifully –

> "*O Aditi! You are the provider of life-sustaining breath to conscious-being daksh the faithful follower of the birth-system. This eternal-pilgrim purush (daksh), enjoying your diverse material gifts, lives the life of diversities. Your endowment of the sapt-hotas (seven-devas) accompany him through all his diverse births"*. RigVeda (10/64/5).

This beautiful RigVeda mantra states the Vedic philosophy of 'birth-rebirth' system that is followed by the '*eternal-pilgrim*', the soul (quantum of consciousness) and expresses that the soul carries out the process of birth through its kinship with the inert Nature which provides the needed matter for soul's physical body. Now let us come back to the 8$^{th}$ mantra just presented. Implicit in the 8$^{th}$ mantra is that even though there was no possibility of biological systems at that early state of the universe, the relationship between the inert matter and the conscious-being souls was

established for the utilization of the Nature. This means that the seven-*hotas*, the first created inert *deva*-forces establish their relationship with all quanta of consciousness right in the beginning of the creation.

This also means that the seven inert *deva*-fields are there in the early part of the creation with which the conscious-being souls, already present eternally, establish a relationship following certain laws under the *ritam* system of the Creator. This relationship between matter and consciousness was also stated in the fifth mantra (RigVeda, 10/72/5) where the *devas* are *amrit-bandhava* the 'brothers-in-immortality' of the souls. Also in the same mantra the statement -*"O daksh (conscious-being) when the Aditi (Nature) comes into existence as duhita, your nurturer, the devas are revealed to you..."* tells us that as soon as the *devas* are created the relationship between matter and the pre-existing conscious-being is established.

In those early moments of the creation when substantive matter for forming the physical body is not created yet the marriage of subtle matter in the *deva* form and the consciousness takes place. The subtle physical body thus acquired by the soul is termed as the "*sookshma shareer*" by Rishi Kapil in Saankhya Darshan philosophy. This "*sookshma shareer*" serves as the seed (foundation) for the substantive-body of the soul when the substantive matter from the 8$^{th}$ progeny of Nature becomes available, when the terrestrial planets are formed and a suitable environment for the biochemical processes to be sustained is established through the universe. The Vedic philosophy on the "subtle-body" (*sookshma shareer*) and the "substantive-body" (*sthool shareer*) of the soul being a separate subject, it is dealt with elsewhere; however a few related comments are included in the following.

The Vedic philosophy asserts that before the substantive matter in the gas-liquid-solid states is created in Nature, the Nature creates matter in the form of *devas* the fundamental properties of matter and the matter forms at the metaphysical level. Owing to the extreme subtlety, the matter-forms at the metaphysical level can interact with even subtler quantum of consciousness. These matter forms are used by the soul to form its "*sukshma sharer*" (subtle-body) at the metaphysical level. According to the Saankhya Darshan there are a total of 18 matter and energy forms (13 *karans* + 5 *tanmaatras*) including the seven *devas* that form the fundamental ingredients which form the soul's 'subtle-body'. In simple expression, the soul right in the early moments of the creation wraps itself

in its '*sukshma shareer*'. The soul continues to have its subtle body till the end of the creation or till the salvation of the soul, whichever comes first. The *deva* energies useful as the ingredients of the subtle-body, being companions of the soul through the creation of the universe, are thus addressed as the *amrit-bandhu* (brothers-in-immortality) of the soul. It is this *sukshma shareer* of a soul in which the strength, properties and quality of existence are determined according to the soul's previous karma balance (spiritual evolution) and it is this subtle-body on which a substantive body is formed when the conditions in the universe improve during the first *yuga* of the creation.

Just as a tiny seed serves as the cause for the birth of a gigantic tree, the *sukshma shareer* serves as the seed for the substantive body. The substantive body with limbs and the physical functions, with mortality in its nature, is left behind and disintegrates when a person dies, while the 'minute-body' of the soul is a permanent feature of the 'eternal-pilgrim' - the soul. The minute-body at death transits with the soul to integrate with another substantive observable body on it, when conceived in the womb. The level of evolution of this minute-body at death of the substantive body is the starting point for the next birth. The quality of the physical body and the quality of life in the next birth relates to the level of the spiritual and metaphysical evolution of the minute-body in the previous birth. Following the cause-effect logic of the Vedic philosophy, the subtler entities are created before the coarser ones; the coarser being the 'effect' of its finer 'cause' preceding it. This is why the subtler *devas* were created first before the substantive *Maartaand* came to be from the leftover *Aditi*.

Using laser light-scattering experiment to detect a submicron-size minute dust particle suspended in the air the detectability increases when the wavelength of the probing light is smaller than the particle. Relatively speaking this means - subtler entities interact more efficiently with minute entities. The minuteness of the soul-entity was defined in Chapter 5 that it is subtler than any quantum of matter or energy. Therefore, for a soul-entity to benefit from its interaction with matter the Nature's systems and forces have to be at a very subtle level and they have to be created first before the coarser observable universe starts to coalesce later. The Nature, right in the beginning of the creation, presents itself to the souls of the universe with the seven *devas* to complete an important task under the Creator's *ritam*-rule of creation. The Nature is to provide minute ingredients to each soul to

form around it the *sukshma-shareer* (minute-body). Since the souls in the beginning of the creation are there, out of their slumberous state during the *pralaya* (dissolution-phase), they are desirous of doing karma. For that they enter into an association with the *devas*, right in the beginning of the creation, acquire their *sukshma-shareer* and then form the observable substantive body as soon as the order and conditions in the creation are established. The details of what the soul's *sukshma-shareer* (subtle-body) is and how these *devas,* the seeding agents for the observable living body function through a living-being to perform karma and fulfill the spiritual, the intellectual and the physical needs, will be discussed in a separate book.

## Maartaand (primordial Brilliant-ovate) prepares for the Vedic Big Bang

What did *Aditi* do with the eighth child called the मार्ताण्ड (*Maart-aand*, Mortal-ovate)? In the remarkable simplicity of the mantra the *Aditi throws its eighth progeny named Maart-aand (in ovate shape), far-and-wide spreading it over great distances*. An ovate shaped object is thrown *far-and-wide* and *spread to great distances* only when it is broken into pieces. Therefore the implication of the second line of the mantra is that there is an explosion in *Aditi*'s 8$^{th}$ child and its pieces are hurled over large distances in space. The *Maart-aand* carries the entire weight of the observable universe which must have a tremendous inward gravitational pull. To spread this gigantic mass far and wide in Space means a tremendous explosion in the *Maart-aand*. This is the Vedic Big Bang for which the author has developed the Vedic Scenario for the creation of the universe. This is the theme of the *Bhavavrittam sukta* (Creation of the Universe) of RigVeda discussed under the "Vedic Creation Principle" (Chapter 6). Since the *Maartaand* is the name given to the last portion of *Aditi* the mantra automatically furnishes its shape, that it is an observable substantive three dimensional spheroid. This *Martaand* is the raw material of the observable universe. Brief interpretation of the Sanskrit term *maartaand* is in order.

The word *maartaand* represents a noun which is specific to the Vedic Cosmology. The sound of the letter "t" in this word is soft as in the word 'hearth'. It is a compound word, formed with two words *mart* + *aand*. The

word conjugation rule in Sanskrit changes the spelling and the sound, resulting in *maartaand*. The first word *mart* is an adjective representing a general property of the object while the suffix *aand* primarily represents the form (geometry) of the object. The term *aand* therefore reflects the specific properties pertaining to its shape. The *mart* adjective stems from the word *martya*, meaning a substance that comes into existence and has the property of degeneration and mortality. In the Vedic Philosophy in general, anything that has come into existence is mortal. The meaning also includes a substance that is transient or which exhibits continuous change and decay. In the case of living-beings, although the soul is immortal, the functioning substantive body exhibiting the soul's presence is mortal.

Therefore all living-beings having a life-span are labeled as *martya-dharma* (or *maran-dharma*), which means – "*one that follows the law (dharma) of birth and death*". Because their physical bodies die (not the soul), the living-beings are termed as the *maran-dharma* or the 'mortal-beings'. In the case of the observable inert substances of the universe, including the Earth, the Sun and the cosmos, all are said to be *martya-dharma* because they exhibit change and decay with time even though the change may be slow and long-term. At the end of the creation of course all substances disappear including the *devas*. However, the seven *devas*, the inert entities, addressed as the *amrit-bandhava* (brothers-in-immortality) of the soul, in the fifth mantra (RigVeda, 10/72/5), remain as permanent features of the creation till the end of the creation. This is why the Veda has categorized the creation into the category of *deva* and the category of *martya*. In the context of the text of the mantra given below, the 8$^{th}$ progeny of Nature is described as an *aand* (egg-shaped) with *mart* adjective prefixed to it which represents a three-dimensional ovate with transience in its nature.

The name *Maartaand* leads one to think that it is substantive and a subject of perception. This is why this author puts it in the category of the observable matter of the universe. After the *devas* are created as separate entities, the oblate-shaped primordial matter (Figure 8.1) is the beginning for the observable part of the Vedic universe. Since the nature of an egg is to metamorphose, it is the *Maartaand*, the 8$^{th}$ progeny of *Aditi* that serves as the primordial matter of the universe out of which are created all the observable cosmos hurled through the space.

The last mantra of this series is basically a summary of the creation process with *devas* and the observable cosmos formed sequentially out of the same *Aditi* (Nature). Additionally, the mantra states the purpose of the creation.

सप्तिभ: पुत्रैरदितिरूप प्रैत्पूर्व्यं युगम् ।
प्रजायै मृत्यवे त्वत्पुनर्मार्ताण्डमाभरत् ॥ (RigVeda, 10/72/9)

**Transliteration:**

"*Saptabhih putrai-aditi-roop praitpoorvyam yugam ।*

*Prajaayai mrityave tvatpunar-maartaandam-aabharat* ॥"

**Mantra Translation:**

> *"In the beginning yuga of creation the Aditi proceeds with its seven progeny, that would enable the process of birth and death for conscious-beings (souls) and it fills the entire universe with ever-changing mortal-ovates from her eighth progeny named Maartaand."* (RigVeda, 10/72/9).

This mantra again puts a time-stamp on the process of creation, stating that all major first creations take place in the first *deva-yuga*, which by Vedic definition is 4.32 MY. This is a remarkable insight into a cosmology which is not only different from other non-Vedic creation scenarios, but with the exception of some common features, it is also different from the modern cosmology. Contrasting with the modern Big Bang Hypothesis wherein the beginning of creation is with an explosion in the dimensionless space at t = 0 sec, the explosion in the Vedic Big Bang is the second stage of the creation, the first stage being the formation of the seven *deva*-energy fields. The other Vedic references, including the above mantra, state that it took one *deva-yuga* period of 4.32 million years from the time-zero of the Vedic creation when the big explosion took place in the 8$^{th}$ progeny of Nature named *Maartaand*. This period of 4.32 MY is not for the *Maartaand* to be idle but for it to go into *paryaplav* (rotation in floatation) for

developing the required heat energy to cause an incredible explosion that breaks up the *Maartaand* into *koti-koti* (innumerable) pieces, which are hurled far and wide in space.

In addition to the differences in the mechanism and sequence of events in the two cosmologies, there are also significant differences of philosophical nature. According to the mantras these differences pertain to the purpose and the usage of the creation. In modern cosmology the energy and matter are created and let loose to form the universe without purpose and the living creation appears in it as an accident, without purpose. The creation in the Vedic Cosmology is with purpose and usefulness and the consciousness phenomenon is an integral part of it.

# The Seven Primary Vedic Devas

Since the Vedic nomenclature is based on the virtue, property and function of entities, the name of a *deva* reflects one or all of these factors, leading to multiple names for each *deva* in the same way as the other major entities of the universe have a large number of synonyms (Chapter 5). Although the mantras in other *suktas* of the Vedas and the subsequent ancient Vedic Literature are full of praise for the virtues and functions of the *devas,* the *Deva sukta* 10/72 of RigVeda in particular does not provide their nomenclature nor does it state the proportions of Nature used in creating the *devas* and the observable universe. The *sukta* does not tell us about what makes the seven *devas* different from each other. An obvious reason for this *sukta* emphasizing the eighth progeny of Nature and not giving any details of the other seven progeny that are addressed as the *devas*, is because the other chapters in the Veda and numerous *suktas* prior to the *Deva sukta* have already been devoted for the praise of these and other secondary *devas* born in the post-Vedic Big Bang period.

Since the Vedic *devas* are Nature's first creation, they are part of the universe and the Veda stipulates that the creation was not possible without them; the *devas* are integral to the Vedic story of the universe. The studies of the Vedas and the Vedic Literature led this author to understand that the subject of the Vedic *devas* is deep, complex and out of the scope of this book; only the bare-essentials about the *devas* are included here. Based on the mantra references, the names of several of the seven *devas* were preempted by this author and their salient properties discussed. These invisible fields of energy and matter, inter-pervading each other, are symbolically shown in Figure 8.1 in differing shades of colours surrounding the *Maartaand*. The Vedic reference on the proportion of Nature (matter) consumed in creating these seven *devas* is presented later in this chapter.

Some Vedic scholars may not be in agreement with this author's understanding of the order in which the seven *devas* were created and named. The disagreement may also be on the way this author has interpreted the constitution and functionality of the *devas*. However, wherever possible this author has included mantra references to substantiate his understanding of the *devic* science in the Vedas. As understood by this author the seven *devas* are listed below in the order of their minuteness.

## *Devas* in the Metaphysical Realm:

(1) *Buddhi-tatva* –Intellect-element
(2) *Ahankaar-tatva* –Ego-element

## *Devas* in the Physical Realm:

(3) *Aapah– devata* representing the fundamental state of matter in triplet (*sata*, *raja*, *tama*)
(4) *Agni – devata* representing energy (heat)
(5) *Vaayu – devata* representing motion and action
(6) *Indra– devata* representing electricity
(7) *Som– devata* representing the chemical-bond energy of the universe

Of the seven primary Vedic *devas* listed above the first two (*Buddhi*, *Ahankaar*), though products of matter, are extremely minute in their form, such that they are beyond the subject of common physics experiments and only their effects are discernible. These two *devas* function through the conscious-beings and have no presence in inert matter. Therefore they can be considered in the realm of metaphysics.

The Vedic cause-effect principle suggests that the matter in the *srishti* phase is coarser than in the *pralaya* phase. A logical sequence in such a creation required that the first forms of matter created in *srishti* be subtler than those created later. The Vedic creation therefore begins with subtler forms of 7 invisible *deva*-fields followed by the $8^{th}$ observable *Maartaand* in relatively coarser form. The most minute among the first 7 progeny of *Aditi* is the ubiquitously available energy-field called the *Buddhi-tatva*

(Intellect-element), also commonly known as the *Mahata-tatva*, meaning the 'most superior element' of the Vedic philosophy. The non-material soul-entity being subtler than the subtlest of matter quantum, the Intellect-element is manifest through the living creation followed by the other 6 *devas* with their respective functions.

The three *devas* - *Agni*, *Indra* and *Som*, being in the physical realm are familiar to a physicist because they respectively represent energy, electricity and chemical-bond energy. In Vedic philosophy however they are a subject of deeper understanding than their mere harnessed amounts in the experiments of physics or chemistry.

While the rich nomenclature with synonyms in the Sanskrit language provides a nearly exact description of a phenomenon or a substance in a given state, it can easily lead to an erroneous understanding when the right context is not applied. For example not having gone deeper into the understanding of the *devas* of the physical realm, the *Aapah* and *Vaayu devatas* are generally misunderstood to be just 'water' and 'air', respectively. The *Vaayu-devata* of the Veda is not just something that creates wind in the air. Just as the mass is a fundamental property of *Aapah* (matter) that causes the matter-matter attraction (gravity), the *Vaayu* is the inherent property in matter that enables the motion in matter.

The *Vaayu-devata* therefore is found operating at all scales of Space from the inner confines of a tiny atom to the spinning galaxy and everything in between. The *Vaayu-devata* also creates the speed in a photon - a carrier of *Agni-devata*. A Vedic adjective associated with the *Vaayu-devata* is the अज्ञात वायु देवता (*agyaat Vaayu-devata*) - the '*invisible devata of motion*'. The *devata* of motion is said to be 'invisible' because its effect is seen but the *devata* (force) itself is not seen. For example when a visible body in motion appears at a point P in space and time and then appears later at another point Q in another space and at another point in time, the body is the same at P as well as at Q, but one does not see the force behind the displacement. This force is the *agyaat Vaayu-devata*.

A fair bit of discussion on Indra-devata was included earlier in this chapter under the sub-heading "*Indra-devata* the Electricity" and considerable discussion on *Aapah-devata* was presented in Chapter 5, the *devata* all-pervading through even the so-called vacuum of Space.

The seven *devas* are the subject of many mantras and *suktas* of the four Vedas where their names appear, their virtues are praised and their physical

properties are stated; all in relation to their utilization in the physical phenomena of the universe and for the benefit of living-beings. The subject covers their connection to the physical, the spiritual and the philosophical aspects. This author feels that to grasp the concept of *devas* one has to exalt one's mind above physics and bring it into the realm of philosophy.

The *Munn*-entity (Mind-entity), discussed earlier, is not a part of the above list of the *devas*. The Vedic references indicate that the *Munn*-entity is an individualized quantum which is the indweller of the Intellect-entity (*Buddhi-tatva*) of a soul. It is subtler than most substances in the universe and therefore it is the fastest physical entity of the Vedas.

The modern Big Bang Hypothesis provides information on what proportion of the universe is matter and energy and what proportion is Hydrogen and Helium and what proportion of the matter is Dark Matter. It is remarkable that the ancient Vedic cosmology should have talked about what proportion of matter is consumed in the *Deva* fields and how much is used for creating the cosmos. The answer to this question, based on the mantra references, is provided in the following.

## Matter distribution between the Devas and the Observable Universe

To the best of this author's knowledge, the Vedas do not assign a specific number to the mass of the universe in terms of the Vedic weight measure unit of *mana* (37.324 kg) in a manner assigned in kilograms by the modern astronomers. It is however interesting to note that the Veda makes specific mention of the mathematical proportion for the mass distribution of the universe between the *deva* fields and the observable matter. The best available telescopes can fathom the limits of the observable universe and measure the matter density in it. The astronomers use about half a dozen different methods to calculate the mass of the universe. The estimates yield a range of values anywhere from $10^{54}$ kg to $10^{60}$ kg. A variation of 1 million kg in this range indicates that the estimate of the mass of the universe by the modern cosmologists is at best a rough guess. The estimates suggest that the mass of the universe is distributed as: ordinary mass

(4.8%), neutrinos (0.1%), cold Dark Matter (26.8%) and Dark Energy (68.3%).

Occasionally, a Veda mantra expresses a profound thought mysteriously through a parable or a riddle, a simile or with a literary poetic adornment. Or, a straightforward question is raised by the *rishi* in the mantra's first line and the answer to it may be furnished in the next line. At other times a mystery is created in the mantra and revealed either in the same mantra or in another mantra. This tickles the mind of a learned reader of the Vedas to find the hidden meaning either within the same mantra or in other mantras.

Finding the answers to such questions was quicker in ancient times when Vedic scholars used to learn by heart each and every mantra of the four Vedas in the same sequence as they have existed since eons. When the whole Veda was in the memory of a scholar the right mantra from another chapter and *sukta* would pop up in the Vedic scholar's mind conveying the required answer. The ancient Aryan/Vedic tradition still continues in some parts of India, in a limited way, where scholarly people and students of the Vedas learn by heart all the mantras of all the four Vedas. It is a task requiring dedication and continuity in practice because the amount of learning one has to do is tremendous as the RigVeda alone has 10,521 mantras in it. At the same time learning by heart a total of 20,348 mantras of all four Vedas in the correct sequence of the mantras, *suktas* and chapters, certainly gives such scholars a tremendous advantage for finding the answer to a question raised in a mantra. Others however find the answer to the question raised in a mantra arduously. This author presents three mantras in the following that put forward questions that seek answers pertaining to the mass/energy proportionality of the universe. These mantras state that "*only half the universe is observable*" and encourage the reader to find out and understand where and in what form the other half exists.

The Vedic perspective being theistic, with the Creator as the most supreme omniscient entity, one is instructed to meditate upon the Creator for finding the answers to the questions raised in the Veda mantras. This would make sense to a theistic Vedic reader when the Creator is assumed to be a conscious-being and could also be meditated upon for positive results. Contrary to this perspective is the modern cosmology's premise, stated by a prominent cosmologist, "*…the gravitation alone is sufficient to create and sustain the universe and the God was unnecessary"*. Then, in modern

cosmology, the '*gravitation alone'* becomes the cosmologist's *devata* to meditate upon for answers. A general definition of meditation is to concentrate one's mind desisting unnecessary thoughts. The applied meaning of meditation is to go into deep thinking on a specific subject for seeking answers. The basic approach for finding answers is the same in the atheistic as well as in the theistic frames of reference. The difference however is that an atheist cosmologist meditates upon only one *devata* (i.e. gravitation) and the theist Vedic scholar invokes in succession two *devatas*; the Conscious-being Creator for inspiration and enlightenment of the mind and the inert *devata* of the main subject matter (i.e. gravitation).

When the intention in the Veda mantra is to convey knowledge about a physical phenomenon it should not matter whether the mantra is from a theistic book or an atheistic book. This is the situation for the two AtharvaVeda mantras cited below. One mantra (AtharvaVeda, 10/8/7) talks about a few properties of the universe: the physical shape of the universe, the specific dynamic behaviour of the universe, the assignment of half the matter for forming the cosmos and then it poses a question –where is the other half? The second mantra (AtharvaVeda, 10/8/13) asks - what is the defining feature of that other half? The second half of the previous mantra (AtharvaVeda, 10/8/7) pertains to the mass proportion of the universe. It is presented in the following.

अर्धेन विश्वं भुवनं जजान यदस्यार्धं क्व१ तद बभूव॥

(AtharvaVeda 10/8/7).

"*…. Ardhen vishvam bhuvanam yadasyardham kva tad babhoova*"

**Word Transliteration and Translation:**

अर्धेन (*ardhen*) = from the half, विश्वं (*vishvam*) = the entire universe, भुवनं (*bhuvanam*)= celestial objects / cosmos in existence, जजान (*jajaan*) = created , यत् (*yat*) = that, अस्य (*asya*) = this, अर्धम् (*ardham*) = half, क्व (*kva*) = where is, तत् (*tat*) = that (the other), बभूव (*babhoova*) = exists / remains ॥

**Mantra Translation:**

*"….The cosmos in existence in the entire universe is one-half of the whole, then, where exists the other half?"* (AtharvaVeda 10/8/7).

**Mantra Interpretation**

This second line of the mantra has a statement and a question in it. It states that the matter used for the observable cosmos is only half of the total and the other half is in another form, not observable. It is evident from this mantra as well as from the other mantras that the Vedas not only credit the creation to some invisible entity called the Creator but they also take up some accounting of the matter used in this creation. Referring to the observable cosmos, the mantra has raised the question for a curious mind – what you see is *one-half of the whole, then, where exists the other half*'?

The first line of the mantra (not included here for brevity) states that *this creation was a real phenomenon, not an illusion and it follows one* (same) *rule throughout,* implying that the same physical laws of Nature apply to all parts of this universe and that the universe as a whole is "one connected system". This Vedic principle is no different from the first Cosmology Principle of modern cosmology, cited in Chapter 2 which states - '*The laws of physics, verifiable in the laboratory, that apply to the observable objects, apply to all objects of the universe*.'

One sees two possibilities for answering the question in the mantra. First, that the invisible half is used in creating the matter/energy fields consumed in the *devas*, some of which are the same as in modern physics such as the electricity (*Indra-devata*), radiational energy (*Agni-devata*), kinetic energies in cosmic bodies (*Vaayu-devata*) and in atomic structure and so on. Some may be hidden away as unobservable ubiquitously distributed matter (*Aapah-devata*) which could be dominant in the *tamah* (less active) component of the *Aapah*. The *rajah* component of the *Aapah*-triplet is explicitly assigned by the mantras for the matter and energy of the effulgent cosmos.

It was discussed in Chapter 5 and presented in the Figure 5.1 that the ancient book of Taittireeya Aranyak (10/10/5) had assigned three colours to the three components of *Aapah* where कृष्ण (*Krishn* = black) was assigned to the *tamah* component and defined to be the one with the property of "having the tendency of inactivity". By design the 33.33% of the Vedic defined matter of the universe at its fundamental level is कृष्ण (*Krishn* = black), which is similar to the Dark Matter (26.8%) of the modern cosmology which does not emit light. The second possibility for the other half of the matter of the universe is that it is in the real matter-form but far

away beyond our observations. Even in the Vedic perspective, though the starting universe was *'tuchchhaya'* (diminutive), the functioning universe is infinitely large, mostly beyond observations. This is what a physical cosmologist of today finds even with powerful techniques and telescopes. However, there are all indications in this mantra and other mantras that half of the Nature is used up in creating the seven *devas* (all subtle matter/energy fields) and the other half is for the observable matter. Even this observable matter may not all be observable from the Earth and the Veda mantra may have a statement of fact that if one were to observe the entire universe one would find that the observable matter is half of the total matter necessary for the creation of the entire universe.

It is however remarkable that the Vedas should indulge in assigning a mathematical proportion of half-and-half to the observable and non-observable universe. This begs a question as well – how did the *rishis* arrive at such a conclusion? The modern Big Bang Hypothesis also suggests half-half proportion of matter but with a different meaning, that half the matter of the universe is created as "matter" and the other half as "antimatter". But the antimatter is a non-issue because mysteriously it has disappeared from our universe. In the Vedic premise, the both halves are real matter, that are right here and fully participating in both realms of the creation – the animate and the inanimate.

One remarkable feature of the matter apportionment of 50-50 in the Vedic Cosmology is its assignment of 50% to something that is not even visible. One could say that it is just a guess-work by a *rishi* but a guess-work on something is possible when it is measurable and observable. The best guess-work would have been "what you see is what you get" and why say specifically that what you do not see is half of the total? Such a well-defined thought by no means could be branded as primitive. The first half of this mantra stipulating that the entire universe, observable as well as invisible, functions under the same principles, is yet another mind-boggling statement, similar to what is stipulated in modern physics/cosmology!

The theme of another mantra of the same section of the AtharvaVeda is similar to the one presented above.

प्रजापतिश्चरति गर्भे अन्तरदृश्यमानो बहुधा वि जायते ।
अर्धेन विश्वं भुवनं जजान यदस्यार्धं कतमः स केतुः ॥

(AtharvaVeda 10/8/13)

**Word transliteration and translation**:

प्रजापति: (*praja-pati*)= progenitor and governor of population (the Nature in this context), चरति (*charati*) = lives/dwells/moves, गर्भे (*garbhe*)= in the womb (of the Creator), अन्त: (*antah*) = interior, अदृश्यमान: (*adrishyamaanah*) = non-observable, बहुधा (*bahudhaa*) = diverse/many, वि जायते (*vi jaayate*) = specifically revealed ।

अर्धेन (*ardhen*) = from the half, विश्वं (*vishvam*) = of the whole universe, भुवनं (*bhuvanam*) = celestial bodies / cosmos, जजान (*jajaan*) = is created , यत् (*yat*) = that , अस्य (*asya*) = this, अर्धम् (*ardham*) = half, कतम: (*katamaha*) = what is its, स: (*sah*) = that, केतु: (*ketuh*) = distinguishing symbol / defining sign ॥

**Mantra Translation:**

> "*Prajapati (Nature) lives non-observable (indefinable) in the interior of the womb of the Creator, becomes active, populates this universe with many cosmos and thus reveals itself. Out of its half are created the observable cosmos, then, what is the distinguishing symbol of the other half*" (AtharvaVeda 10/8/13).

**Mantra Interpretation**

As discussed before, the *Prajapati* in the mantra is the Nature with cosmos as its *praja* (subjects, population). The *Prajapati* in this mantra is divided into two, the observable form as the celestial bodies and the rest as the invisible matter. The formless all-pervading unitary Creator of the Vedas cannot be divided into two and cannot be made observable. Therefore the *Prajapati* in the mantra is the inert Mother Nature.

The first line of the mantra reflects the deductions from the *Bhavavrittam sukta* of RigVeda that lay the foundation for the Vedic Cosmology Principle discussed in Chapter 6 where the Nature transits from

its non-descript *Asata*-state into a diverse observable *Sata*-state. Notice that the second line in this mantra is mostly the same as in the previous mantra with a slight change at the end. This time the Veda indicates that the things that are in existence do have symbols and markers to draw the distinguishable reference for their existence. Since one-half of the matter of the creation has recognizable signs in the form of celestial bodies with illumination and regular time cycles in them, the other half, being in the invisible form, has no recognizable emblems. The statement with a question in both mantras implies that the other half of the Nature does exist in the universe but is not confined to a particular region of the universe and that it does not have recognizable symbols associated with it. This means that half of Nature is non-observable by physical means.

It is worth discussing one more mantra that also pertains to the matter apportionment. This mantra is from the RigVeda, where the seven *devas* are addressed with an adjective of '*sapt-aardh-garbha*[1]'. When translated word-for-word, it reads – '*the seven from half the embryo*[1]' (of Nature). It is this mantra that has the answer to the question raised in the AtharvaVeda mantras - where was the other half of the matter of the universe?

सप्तार्द्धगर्भा1 भुवनस्य2 रेतो3 विष्णोस्तिष्ठन्ति4 प्रदिशा5 विधर्मणि6 ।
ते धीतिभिर्मनसा ते विपश्चित: परिभुव: परि भवन्ति विश्वत: ॥ (RigVeda, 1/164/36)

Transliteration:

"*Saptaardhgarbhaa*1 *bhuvanasya*2 *reto*3 *vishnostishthanti*4 *pradishaa*5 vidharmani6।
Te dheetibhirmansaa te vipashchitah paribhuvah pari bhavanti *vishvatah* ॥ "

**Word Transliteration and Translation:**

सप्त (*sapt*) = seven, अर्द्धगर्भा1 (*ardhgarbhaa*) = half of the embryo / half of the pregnancy, भुवनस्य2 (*bhuvanasya*) = of the universe, रेत:3 (*retah*) = (creating) the seed of matter, विष्णो: (*vishnoh*) = Vishnu the all-pervading Creator, तिष्ठन्ति4 (*tishthanti*) = are established, प्रदिशा5 (*pradisha*) = with the direction of / guidance / supervision, विधर्मणि6 (*vidharmani*) = (the Space-entity) of

opposite dharma / which follows different principles/of opposite properties / of different properties ।

ते (*te*) = they, धीतिभि: मनसा (*dheetibhih manasaa*) = with the thirst of knowledge, ते (*te*) = those, विपश्चित: (*vipaschitah*) = learned, परि-भुव: (*pari-bhuvah*) = all-rounder in scholarship, परि भवन्ति (*pari bhavanti*) = all-around rejected , विश्वत: (*vishvatah*) = from all-around ॥

**Mantra Translation:**

> *"Those sapt-ardh-garbha[1], the seven born out of half the embryo, are the first matter-seed (retah3) of the universe (bhuvanasya2). Under the superintendence (ritam) of Vishnu, the all-pervading Creator, they establish themselves within the* विधर्मणि**6** *(vidharmani6), the Space-entity the follower of different dharma (principles). This reality is understood by the learned intellectuals with the thirst of knowledge who receive respect and praise from all-around and those who do not understand it are ignored all-around"*. (RigVeda, 1/164/36).

A straightforward deduction from this mantra is that the 7 invisible *deva* matter/energy forms are created first, consuming half of the matter of the Nature-entity right from its most fundamental state and right at the inception of the universe. A short elaboration is in order.

The properties help identify substances and entities. If two different things had the same property, it could create confusion in identifying which is which. Therefore the Vedic philosophy has laid emphasis on the defining signs (*lingas*) and on the differentiating *dharma* that a substance or an entity follows. The above RigVeda mantra is talking about the creation of the seven entities (*devas*) out of the half of the primordial matter of the universe, which, after their creation, have to be placed (contained) somewhere. The container holding all substances of the universe is the pre-existent real entity called the *Akaash-tatva* – the Space-entity. The question arises – after the seven entities are created and contained in the *Akaash-tatva*, do they merge unidentifiably with the container? The mantra's emphasis is that they remain distinct from each other because they are

counted as seven and they do not become part of the container, the *Akaash-tatva*, because the *Akaash-tatva* (Space-entity) in this mantra is declared as a विधर्मणि$_6$ (*vidharmani*) entity. A *vidharmani* entity is the one that follows completely different *dharma* (follows different laws).

In the physics terminology, the Space-entity comprises properties other than the properties of matter. As an example, if a glass of well-water is poured in a water-tank, the well-water will merge with the pre-existing water in the tank because both waters are सधर्मी (*sa-dharmi* = of the same *dharma*). But if a glass of water is poured in a barrel of oil, the water and the oil will not mix, keeping their separate identities because the two are विधर्मी (*vidharmi* = of different *dharma*). The term विधर्मी (*vidharmi*) leads to the adjective-noun विधर्मणि$_6$ (*vidharmani*) in the mantra for the Space-entity, differentiating the Space-entity from the seven matter entities created out of half of the matter of the universe.

The mantra's emphasis in the context of the *devas* is that different laws govern the Space-entity than those governing the *devas* or the matter in general. The term *dharma* of the Vedic philosophy has universality in it in the sense that it applies to all substances in both realms – animate and inanimate (conscious-beings and the inert). Each entity created in the universe follows its own *dharma*. *Dharma* of a substance comprises the '*laws and principles that it follows*' or the '*principles under which the substance has its existence*'. In this context the physical laws of Nature are followed by the invisible *devas* as well as the rest of the matter and separate laws apply to the Space-entity which in the Vedic science is an independent eternal entity. This means that the created *devas* and the Space-entity are two different entities following different laws. The Vedic differentiation of matter and Space through their opposite/different *dharma* is quite remarkable.

Humans are instructed in this mantra to be cognizant of the existence of the 7 primary *devas* and the Space-entity. Those who understand that the *devas* are formed out of half the matter of the universe and also understand their function in the universe, especially their relationship to living-beings, are considered by the Vedas to be scholarly. This is further upheld in the next mantra in RigVeda, (1/164/37) which expresses that –

"*Those without the cognizance of the devas and their functioning through living-beings, will not have their knowledge senses functioning properly to gather knowledge and even the needed voice to express that knowledge, will not be present in them*". RigVeda, (1/164/37).

This mantra takes the reader to yet another dimension in the living creation. It implicitly differentiates the ability of cognizance leading to eloquence in humans versus the other species.

The specificity of the proportion of 'half' the matter of the universe used in the formation of the *deva* energy/matter fields is not a figure of speech because the same theme is repeated in several mantras. In the two AtharvaVeda mantras the context of "half" was from the perspective of the *Maartaand*, the observable universe, while in the RigVeda mantra, the context was from the perspective of the 7 invisible fields of the *devas* which provide sustenance to the universe and function through the living body as well. The specific adjective in the RigVeda mantra of सप्तार्द्धगर्भा1 (*saptaarth-garbha*), "*the seven from half the embryo*", leaves no doubt that the reference is for the first 7 of the 8 progeny of *Aditi* (Nature). Thus the Veda raised a question and answered it, that the Nature is divided into half-and-half, between the observable matter and the invisible energy forms.

From their estimates of the observable universe the astronomers find that a considerable fraction of the universe's mass remains unaccounted for. The term for this mass is the 'missing matter' of the universe. They assign this missing matter to the Dark Matter and the Dark Energy of the nature and properties not well understood yet. It is interesting to note that the Vedas posed similar questions and queries. Veda mantras posed these queries in cosmology well before the most known civilizations on the Earth did; the modern cosmology included. Another significant factor is that there is a deep cognizance and awareness in Vedic cosmology that the two halves of Nature (mass/energy) function at the macro scales of the universe and also at micro levels within the living-beings. What forces work through the living-beings is of no interest to the modern cosmology.

This section is concluded with two statements from Shatpath Brahmana (10/1/3/1-2), the ancient book of commentary on the YajurVeda

mantras. On the proportion of matter and energy in the universe, the book of Shatpath Brahmana expressed the same thought with a touch of mystery:

> "*Prajapati, the progenitor* (Nature) *created its population* (cosmos). *Prajapati created the (unchanging) devas from its upper praana (breathing/vibrations/ oscillations) and the (ever-changing) mortals (cosmos and living beings) from its lower praana*." (Shatpath Brahmana, 10/1/3/1)

Then in the successive statement it states:

> *"This Prajapati's half apportionment was mortal and the other half immortal…*" (Shatpath Brahmana, 10/1/3/2)*"*.

It is clear from the several different sources within the Vedic perspective that half the universe is in the form of the 7 permanent *deva*-energy fields and the other half is in the form of the transient observable matter. This may lead a modern cosmologist/astronomer to have a fresh line of thought on the investigation and interpretation of the various cosmological approaches, deductions and the astronomical observations made thus far. This information is of great physics significance for the modern cosmologists.

# CHAPTER 9:
# Heat Energy Eh and Rotational Energy Er are the Fundamental Tools of Creation

Once the *srishti* (creation) phase is triggered with the matter transiting from *Asata*-state to *Sata*-state (Figure 7.1 and 8.1), all matter properties in the fundamental triplet of *aapah* are 'awakened'. This awakening triggers all the laws of physics (*satyam*) which lead to specific combinations of *sata*, *raja* and *tama* fundamental particles. This is the phase when differing corpuscles of differing energies, forces and the other particles are created out of the *sata*, *raja* and *tama* particles. As this author has understood it, according to the Vedic physics each fundamental particle of matter, a corpuscle of energy including an electron and a photon is made up of the combination of the tri-property *aapah* (*sata*, *raja*, *tama*). The differing energy forms serve as *devatas* in shaping the universe; the most usable form of energy being the *Agni,* the heat energy $\mathbf{E_h}$.

As mentioned before, the ancient Rishi Yask in his Nirukt *sutra* (5/1/3/1) cited Acharya Sthaulaashttheevi (**स्थौलाश्ठीवी**) stating that the basic property of *agni* (heat energy) is *aknopan* (अक्नोपन), meaning - '*it creates separation in substances*'. Rishi Yask also cited (Nirukt, 7/4/1/1) another ancient *angirasa* (scholar of thermal physics), Acharya Shaakpooni (शाकपूणी) who stated three principles in thermal physics that the *agni* ($\mathbf{E_h}$) is a *tribhya akhyatebhyaha* (tri-property) entity responsible for three effects: (a) इतात् (*itaat*) → '*one that creates motion*', (b) अक्तात् (*aktaat*) → '*one that creates illumination*' and (c) दग्धाद् (*dagdhaad*) → '*one that burns substances'*. No one can dispute these insightful ancient deductions in thermal physics.

The important points relevant to the Vedic Big Bang are: (1) that the dark cold *Maartaand* is transformed into a brilliantly hot and *illuminated Hiranya-aand* (Golden-embryo) owing to the property of अक्तात् (*aktaat*) in $\mathbf{E_h}$, '*one that creates illumination*' (2) that the property of इतात् (*itaat*) in $\mathbf{E_h}$ *creates motion* in the *Maartaand* leading to the creation of kinetic energy and (3) that the basic property of *aknopan* (अक्नोपन) in $\mathbf{E_h}$ *creates separation in substances* in the brilliantly hot *Hiranya-aand,* leading to the Vedic Big Bang.

The $\mathbf{E_h}$ having the property of इतात् (*itaat*) to *create motion* in substances also means that it gives rise to the translational energy in linear and angular motions. It is the rotational energy $\mathbf{E_r}$ of the *Maartaand* that is the subject of several Veda mantras to follow.

Once the *Eekshana*-Mind energy $\mathbf{E_{e\text{-}m}}$ of the Creator provides the extrinsic trigger to transform the indefinable *Asata*-state of matter to the definable *Sata*-state of matter, the matter thereon functions under the physical laws of Nature which in Vedic terminology is "*satyam*", defined in Chapter 5 in Volume 1. This matter-matter transition in the Vedic principle begins at True Absolute Zero Temperature. The Nature's laws and the properties of matter then lead to the development of heat energy $\mathbf{E_h}$ in the conglomerate of primordial Nature. A mantra presented in the following explicitly states that the matter particles 'toiled' hard for a Veda prescribed definite period of 4.32 million years to develop heat energy $\mathbf{E_h}$ and the rotational energy $\mathbf{E_r}$ in the primordial matter oblate.

In the modern Big Bang Hypothesis on the other hand, the fundamental matter particles of the space-time singularity, right after t = 0 sec of the Big Bang, developed mass and other properties. With enormous mass in matter, the gravity would cause gravitational collapse leading to the release of gravitational potential energy as heat $\mathbf{E_h}$. The dimensionless space-time singularity in the modern Big Bang begins with infinitely high temperature. This is one of the basic differences in the two mechanisms.

The next step in the Vedic Creation Scenario therefore is as depicted in Figure 9.1 wherein the heat energy $E_h$ is symbolically added to the primordial *Maartaand*. When it is said here that the heat energy is added to the system, it only means that the physics of the system develops heat energy

following the physics laws that come into effect during the *Sata*-state of matter.

The development/addition of the heat energy $E_h$ is shown by the illuminated interior of the black spheroid of the primordial matter on the left side of the figure. This over a period of time leads to the golden-red-hot *Hiranya-garbha* (Golden-embryo) depicted on the right-side of the figure.

Based on the Vedic references cited earlier and some more to come in the following, the heating process begins in the interior of the *Hiranya-garbha* (Golden-embryo). This is what would happen from the modern physics perspective as well. This stage of the primordial ovate of *Aditi* is addressed with several adjectives such as the *Hiranya-garbha* (Golden-embryo), *Hiranyaand* (Golden-ovate), *Brahmaand* (Creator's - ovate), *Martaand* (Mortal-ovate) and so on. As an example on a smaller scale, the Earth is a *Hiranya-garbha* (Golden-embryo) with brilliantly hot interior.

That the heat energy plays the vital role in shaping the universe is stated in numerous mantras; only a few will be cited here. The important ones are taken from the *Bhavavrittam sukta* of RigVeda (10/129/3, 10/190/1) and interpreted in Chapter 6 (deductions 9 and 23). The relevant parts of the mantras with reference to the तपस: (*tapasaha* = heat energy $\mathbf{E_h}$) are recalled here for continuity. The most relevant terms are superscripted:

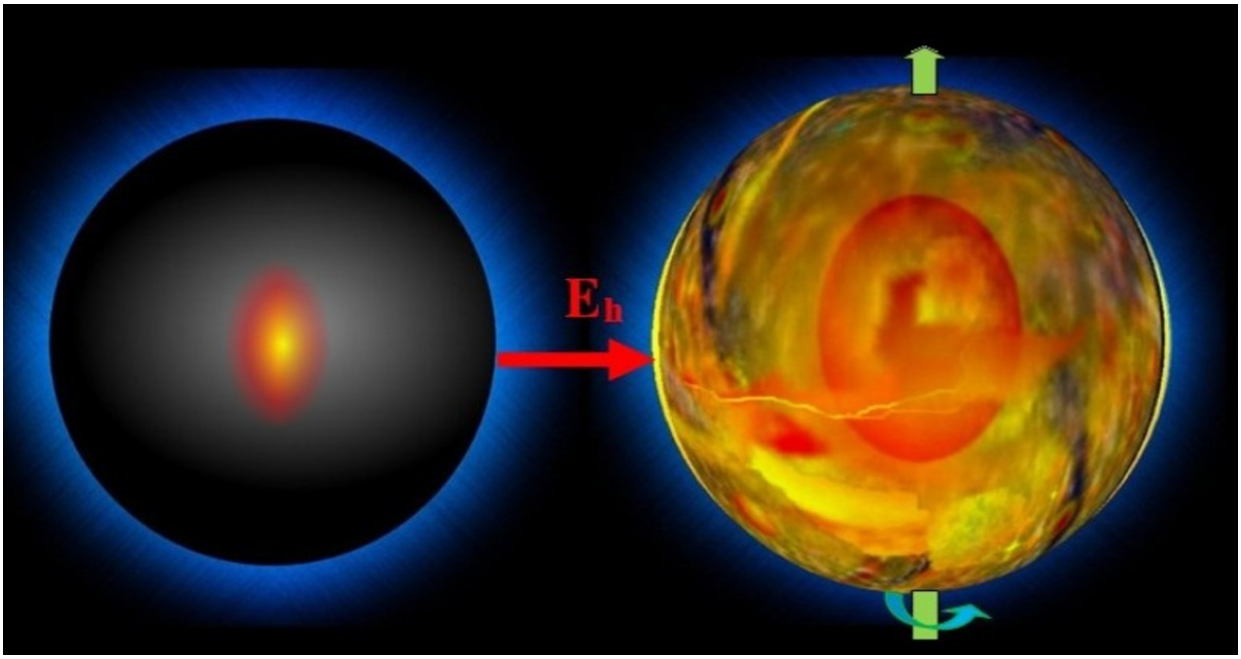

**Figure 9.1: (SIDE VIEW):** The *Aditi* (Nature) is energized internally by developing heat energy $\mathbf{E_h}$. The Golden-embryo (right) is its next stage with the central interior brilliantly hot. The 7 *deva* fields are not shown separated. The embryo begins to rotate.

तुच्छ्येनाभ्वपिहितमं यदासीत्तपस1स्तन्महिना जायतैकम् ।।

( RigVeda, 10/129/3)

**Transliteration**:

"Tuchchhayenaabhvpihitam yadaaseettapastanmahinaa jaayataikam"

**Mantra Translation:**

"*….Due to Brahmn's (Creator's) great influence of heat energy* (**तपसः** = *tapasah*) [1], *the Nature from its causal state comes into active state of matter*",

and

ऋतं च सत्यं2 चाभीध्दात्तपसो1ऽध्यजायत ।**...**।।

(RigVeda, 10/190/1)

**Transliteration:**

**"***Ritam cha satyam chaabheeddhaattpaso[1] addhyajaayata ।….*।।"

**Mantra translation**:

*"Under All-illume Creator's* ***ritam*** *and* ***satyam*** *rules* (rules governing spiritual and material creation) *and His* ***tapasaha***[1] *the heat form of energy, the Nature comes into its day-epoch of creation …."* (RigVeda, 10/190/1).

In a physics perspective of the cosmology, the prime player in the creation process according to the above mantras (RigVeda, 10/129/3; 10/190/1) is the heat energy $\mathbf{E_h}$ - the *tapasah*[1]. The general term for energy is *Agni*. Several other Veda mantras emphasize *Agni* as the prime player in sculpting the universe. The RigVeda mantra (10/129/5), included in formulating the Vedic Creation Principle in Chapter 6, had led to the deduction (13) that stated:

***"Origin of the Vedic universe is with instantaneous expansion of matter under the influence of heat energy."***

This is what the heat energy (*Agni*) is expected to do because as stated in the ancient theorem of Acharya Sthaulaashttheevi (**स्थौलाश्ठीवी**) cited above the *Agni* has the property of *aknopan* (अक्नोपन), it '*creates separation in substances*'. In the present context it causes the *instantaneous expansion of matter* leading to the Vedic Big Bang when the matter is hurled (*Aditi*'s 8th progeny) far and wide. The heat energy $\mathbf{E_h}$ is therefore symbolically added to the primordial matter (Figure 9.1). Even though several steps in the process are simultaneous, the Vedic Big Bang scenario is depicted here in steps through several diagrams.

Other cosmological processes in the formation of the universe and different physical features of the early universe are also a novelty of the Vedic Big Bang that should provide ample food for thought for a modern cosmologist. A few mantras on this aspect are taken up here particularly from the AtharvaVeda, the fourth Veda, which set the stage for the Step-3 in the Vedic Creation process. These physical processes and features in the primordial embryo of the universe are unique to the Vedic Cosmology with the exception that one such physical feature of Vedic Cosmology (discussed below) is also observed in the galaxy formation - an amazing ancient deduction in Vedic cosmology!

When it is said that the heat energy $\mathbf{E_h}$ plays a major role in the Vedic Scenario a physicist would like to know what physics process generates this heat in the primordial matter? One cannot expect the ancient Vedic science to provide a comprehensively developed physics mechanism (algorithm) with differential equations and mathematical elaborations. However, the Veda and the Vedic Literature do provide deductive insight based on qualitative statements.

When one taps into the ancient Vedic references associated with the early stages of the universe one finds that the golden brilliance in the *Hiranya-garbh* (Golden-embryo) is assigned to the glow of the *aapah*, the fundamental matter particles of Nature defined and discussed in detail in Chapter 5, Volume 1. The source of this glow in *aapah* is said to be the *Agni* (energy), also synonymously expressed as the *tapah* (heat). Two statements from the Shatpath Brahmana (11/1/6/1, 2) presented below are intriguing.

One finds a treasure-trove of Vedic terminology in a single Brahamana statement on the subject of cosmology. The terms describing the creation aspect of cosmology are: *aapah*[1] (most fundamental particles), *salilam*[2] (the

Nature in causal state, dissolved state), *praja*[3] (population, celestial bodies), *tapah*[4] (heat energy), *hiranyam-aand*[5] (golden-ovate), *samvatsar*[6] (a defined period in a time cycle), *pari-plava*[7] (rotary motion in floatation), *purusha*[8] (the Creator) and *Prajapati*[9] the Nature at the stage of *Aditi* as the progenitor of its population (cosmos). While the Veda mantras are in metered poetry, the Brahmana statements are in straight prose narratively expounding the hidden knowledge in the mantras. The Shatpath Brahmana narrates the early state of creation using terms in mechanics, physics and cosmology:

आपो[1] ह वा इदमग्रे सलिलमेवास[2]। ता अकामयन्त । कथं नु प्रजा[3]येमहि इति । ता अश्राम्यन् । तस्तपो तप्यन्त[4] । तसु तप[4]स्तप्यमानासु हिरण्मयमाण्डं[5] सम्बभूव । तदिदम् हिरण्मयमाण्डं[5] यावत् संवत्सरस्य[6] वेला तावत् पर्यप्लवत[7] ।1।

ततः संवत्सरे पुरुषः [8] समभवत् । स प्रजापतिः[9] … स इदम् हिरण्मयमाण्डं[5] व्यरुजन्नाह तर्हि का चन प्रतिष्ठास तदेनमिदमेव हिरण्मयमाण्डं[5] यावत् संवत्सरस्य[6] वेलासीत्तावद्बिभ्रत् पर्यप्लवत[7] **।2।** (Shatpath Brahmana, 11/1/6/1,2).

**Transliteration:**

*Aapo*[1] *ha vaa idmagre salilmevaas*[2]*। ta akaamyant। katham nu prajaa*[3]*yemahi iti। taa ashraamyan। tastapo tapyant*[4]*। tasu tap*[4] *astpyamaanaasu hiranmayam aandam*[5] *sambabhoova।tadidam hiranmayam aandam*[5] *yaavat samvatsarasya*[6] *velaa taavat paryaplavat*[7] ।1।

*Tatah samvatsare purushah*[8] *sambhavat। sa prajaapatih*[9]*…sa idam hiranmayamaandam*[5] *vyarujannaah tarhi kaa chun pratishthaasa tadenmidmeva hiranmayam aandam*[5] *yaavat samvatsarasya*[6] *velaaseettavaddhibhrat paryaplavat*[7] ।2। (Shatpath Brahmana, 11/1/6/1, 2).

**Translation**:

*"In the beginning, the aapah*[1] *(fundamental particles) certainly were in salila*[2] *(uniform indefinable causal state of Nature). They were inspired (by Purush's Eekshana power). How do we (aapah) spread in the form of prajaa*[3] *(population)? They toiled hard*[4]*. They worked to get heat energy*[4] *in them. Out of those heated aapah was born the Hiranyam-aand*[5] *(Golden-ovate). At that time there was no samvatsar*[6]*- the defined time*

*cycle. That Hiranyam-aand[5], as long as a samvatsar[6] is, that long, it floated in paryaplav[7]* (पर्यप्लव[7]) *the rotational motion while in suspension* |1|.

*At the end of the samvatsar, the Purush[8]* (पुरुष: [8], the Creator) *was revealed. That was the Prajapati[9] ...He broke this Hiranyam-aand[5]. Then there was no support for it to stay on. This Hiranyam-aand floated unsupported in rotary motion[7] for one full samvatsar" (one deva-year)* |2|. (Shatpath Brahmana., 11/1/6/1, 2).

In the first statement the physical process for the heat creation is stated as - *They (aapah matter) toiled hard. They worked to get heat energy in them. Out of those heated aapah was born the Hiranyam-aand[5] (Golden-ovate).*

The inert *aapah*, as discussed in Chapter 5, are the matter's most fundamental quantized state before atoms and nuclear particles are formed out of them. In the typical literary style in the book of Shatpath Brahmana, the *aapah* are depicted as players in the cosmic creation drama. When the Shatpath says that the inert *aapah* are inspired, it only means that they rise from their inactive state in the *pralaya* (dissolved Nature) to their active excited state in *srishti* (creation) in a way similar to a conscious being transiting from a passive state of sleep to the active awakened state. When the *aapah* are stated to be addressing themselves - *How do we (aapah) spread in the form of population,* the *rishi* author of the Shatpath Brahmana is in fact just posing a question – how did the *aapah* (matter) spread and populate the space with cosmos? The term population in the context of the creation comprises the celestial objects in the universe. Then it is said that the *aapah toiled hard* and acquired heat energy in them. This is another way of saying that the primordial matter of the universe went through a churning period to develop heat energy in it. The *rishi* then depicts the sequential development of the *aapah* – they together formed a brilliant spheroid in the shape of an egg that he calls the ***Hiranyam-aand[5]***. This ***Hiranyam-aand[5]*** of Shatpath Brahmana is the same as the हिरण्यगर्भ**[1]** (*Hiranya-garbham* =

Golden-embryo) of the mantras in the other Vedas, including the one in the AtharvaVeda mantra (10/7/28), to be discussed in the following.

A physics question here is – what is the meaning of the *aapah* developing heat by toiling? It could have several possible meanings - that they were in motion and the frictional forces generated heat in a way similar to the tremendous electricity generated in the terrestrial clouds or that the gravitational collapse of *aapah* released tremendous heat energy and so on. One reason for the *aapah* particles developing heat is furnished in a RigVeda mantra (2/35/10). The relevant part of the mantra states that in the early stage of the universe –

> **"*The Indra-devata* (electricity) *entered into each aapah of the universe creating desired properties in them*"** (RigVeda, 2/35/10).

One learns from Rishi Yask's interpretation of the same RigVeda mantra that the electricity of the universe is the *vaidyut-agni*, meaning, the electrons create *agni* the heat energy. Also, the electricity entering an *aapah* particle is equivalent to atom formation where the electrons orbit around the nucleus of the atom and become part of it.

After the appropriate naming of *Hiranyam-aand*$^5$ for a hot and brilliant conglomerate of *aapah*, the *rishi* of the Shatpath Brahmana tied some loose-ends.

The *rishi* announced that at the time when the *Hiranyam-aand*$^5$ was formed, there was no *samvatsar*. This means that there was no possibility of measuring time, because no celestial objects with orbital periodicity were formed yet to help determine time periods or time cycles in human terms. The term *samvatsar* representing a cyclic period associated with a celestial object was explained in Chapter 5. Just as the solar-*samvatsar* in Vedic calculations is made of 360 sunrises (one Vedic year), the bigger *samvatsars* relate to the creation cycle itself. As also discussed in Chapter 5 the next *samvatsar*, one thousandth of the Vedic creation epoch, is a *deva-yuga* or one *devic*-year, measuring 4,320,000 solar years. Obviously the *rishi* is talking about an event when the solar system did not come into existence yet. Nevertheless to quench the curiosity of his students, as to how long such a state of the *aapah* persisted, the *rishi* gave a hard number and delineated the mechanics of the brilliantly hot *Hiranyam-aand*$^5$. The *rishi* stated in the

last line of the above Shatpath statement (11/1/6/2) that the golden hot ovate, the *Hiranyam-aand*[5], floated in *paryaplav*[7]developing heat energy for one full *samvatsar*.

The *paryaplav*[7] is the dynamic condition of an enormous object when it is "*in rotational motion while in floatation"*. The emphasis in the statement is that it took one *devic*-year measuring 4.32 million Earth-years before it exploded and the celestial bodies began to form. The process of keeping the immeasurably large *Hiranyam-aand* (Golden-ovate) of the early universe in rotational-floatation (*paryaplav*[7]) for a period of 4.32 MY, evinces a tremendous rotational momentum in the mass of the universe. A *paryaplav* (rotation) of the primordial matter of the universe in spheroidal shape is unique to the Vedic Creation Principle. Also unique is the time assignment of 4.32 MY to this rotation.

The *paryaplav*[7] rotation of the Golden-embryo for one full *devic-samvatsar* has been emphasized in the second statement of Brahmana also. At the end of one *samvatsar*, the *Purush*[8] (पुरुष: [8] = the Creator) breaks the Golden-ovate revealing His presence through the process of creation. The meaning of "revealing Himself" through the creation is that a tremendous transformation of Nature from its *Asata*-state to its *Sata*-state has taken place creating an organized system that this universe is. The breaking of the Golden-ovate to create a universe, populating it by the cosmos, is not seen by the Vedas as an accident or a fortuitous event but is seen as the result of the Creator's *Eekshana* power with *visualization, thought* and *desire to create tangible things*. This is the meaning of the all-pervading formless Creator revealing Himself through the diverse yet orderly creation.

In the simile of the sculptor and the sculpture, an undefined piece of stone intended for the sculpture, neither reveals the existence of the sculptor nor does it reveal the signs of *visualization, thought* and *desire*. However, when the sculptor begins to execute his plan using the chisel and hammer and when a perfectly shaped sculpture begins to emerge, the existence of the sculptor is revealed, who might not even be seen standing near his art. The creation of an object by a conscious-being reveals three factors associated with the object: *visualization, thought* and *desire*. The undefined stone is in the likeness of the *Hiranyam-aand*[5], the Golden-ovate. When the Creator breaks the Golden-ovate after it was in *paryaplav*[7] rotation for one devic-*samvatsar* of 4.32 MY, the Creator is said to be revealed because from there

on the universe begins to take shape; the shape that indicates the application of *visualization, thought* and *desire* by a conscious-being.

Regardless of the reference to the Creator in the second statement, the underlying theme obvious from the Brahmana statements and in other Veda mantras is that the advent of the universe is very dynamic and definite. One finds the same emphasis in the Smritis, Sutras and the Vedic Literature in general: that the universe is a definite event at one point in time. The term given to the creation by the Veda is "*srishti*" which also means - "*one that has been created*".

The interesting observation here is that the *rishi* could have hypothesized that the Creator was revealed instantaneously in the first moment of creation when the *Asata*-state switched into the *Sata*-state or he could have hypothesized that the *Hiranyam-aand*[5] floated in space for seven days or for a thousand years or something else. But the *rishi* assigned a definite and substantial period of 4.32 MY, in cosmological scales, indicating a deliberate estimate in cosmology.

The very first action of Nature in the modern Big Bang Hypothesis is the Big Bang in the space-time singularity without floatation or rotation. The conglomeration of matter to form cosmic bodies begins much later and slowler without any consideration to the angular momentum. The inherent angular momentum developed in the Vedic Big Bang Scenario persists and appears in differing forms throughout the life of the universe. All galaxies exhibit angular momentum, all solar systems within a galaxy exhibit it and so on. This is owing to the Vedic Big Bang.

On the right side of the Figure 9.1 is depicted the beginning of the heat energy development in the interior of the black *Maartaand* (Mortal-ovate). The heat development continues in the *Maartaand* from inside out, turning the *Maartaand* into a *Hiranya-garbha* (Golden-embryo). The Vedic Big Bang Scenario in Figures 7.1 and 8.1 is intuitive and plausible compared to the completely counter-intuitive scenario of the modern Big Bang Hypothesis which begins with a space-less point with zero volume of space-time singularity, without any angular momentum, instantaneously exploding and creating $10^{60}$ kg of matter at a temperature of $10^{32}$ $^{o}$K. Let us now incorporate the *paryaplav* rotation in the Vedic Creation Scenario.

# Rotational Energy Er Creates a Rotating Universe

Everything taking part in forming the universe has a common attribute– the motion. From the tiny electron revolving inside an atom around its nucleus, to the gigantic galaxies spinning around their own axes and everything in between are all impregnated with the attribute of linear and rotational motions. The rotation motion includes both – the spin of the object around its own axis and the revolution around another axis. A planet spins around its own axis and also revolves around its parent star; the Sun being the star in our local space. The Sun is tied to the Milky Way Galaxy and while spinning around its own axis it revolves around the centre of the galaxy; along with all the billions of other stars of our galaxy.

There is a brilliant bar-like structure at the centre of our galaxy which perennially spins around its own axis. Does the seemingly all-pervading property of rotation stop at the galaxy level, or, does our Milky Way Galaxy as a whole also revolve around a yet unknown axis? Just as the billions of stars in a galaxy rotate together around the axis of the galaxy, it would be hard to argue that all galaxies of the universe are not revolving together around a bigger galaxy or around a common axis of the universe. Therefore, if all the galaxies are rotating around an axis, the easily drawn deduction would be that the entire universe has been spinning like a wheel. Modern cosmology/astronomy has not suggested that the entire universe is a rotating system, but the mantra formulations in Vedic cosmology have definitely stated that, eons ago.

This unique Vedic principle, that the entire universe is in rotation, is supported by numerous Veda mantras and statements in the ancient interpretive books on the Vedas. Although there is no available Vedic mathematical or Vedic observational proof for it, the Vedic universe as understood by this author, based on the mantras, begins its rotation right in the beginning phase of the creation (symbolically shown in Figure 9.1) when it was in its primordial state. In addition to the other properties of matter, it is the rotation of the universe that has played a crucial role in shaping the universe.

The modern astronomy/cosmology has put forward differing theories on how an individual star is formed and how it acquires the spin around its own axis and how a galaxy with billions of stars is formed and how it acquires rotation around its own axis. This author has presented an argument in the following, which suggests that the same mechanism as suggested by the modern astronomy/cosmology for the rotation in a galaxy or the rotation of a star can be used to support the theory that the entire universe acquired the property of rotation when it was being formed, several million years before it exploded to form the galaxies. The Vedic cosmology references state that the *Hiranya-garbh* (Golden-embryo) exploded after the *paryaplav* rotation into "*koti-koti*" small *Maartaands,* where the "*koti-koti*" hyperbole translates into -"ten-millions-upon-ten-millions", for "uncountable". To create the kind of universe that we have now, the rotation was an inheritance in the *Maartaand's* fate from which it could not escape.

Under the modern Big Bang Hypothesis two processes for galaxy-formation are suggested: Bottom-up and Top-down, which suggest how and when the galaxies and individual stars develop rotation in them. There is general acceptance among Big Bang cosmologists that all galaxies were formed right in the very beginning of the universe's life, within about 500 million years, with no new galaxies being formed now. Keeping these points in mind let us go back in time before 500 million years in the life of the universe when the individual stars and the galaxies (their material) were not separated yet from the mass conglomerate of the universe. At that stage of the universe's formation, the condition of the mass of a galaxy or a future star was the same as the condition of the entire universe itself. The primordial matter of the universe at that time was together at a very high temperature and under high gravitational compression. Therefore a basic question to the theorists of the Bottom-up and Top-down mechanism for galaxy formation is - if a single galaxy with proto-stars in it or a star in a globular-cluster could develop rotation under high temperature and high gravitational compression, why could the primordial universe itself as a whole, not turn into a single gigantic galaxy rotating around its own axis? The plausible answer is - it should. The *Hiranya-garbh* (Golden-embryo of Nature) according to the Vedic Scenario, develops heat energy for a period of 4.32 MY while in *paryaplav* rotation around its own axis. Therefore it is this single gigantic galaxy which explodes and imparts rotation to each

separated clump of the universe, each clump being a future star or a future galaxy.

The Veda mantra references reveal that the early universe at a given point in its early life acquired a tremendous spin. The tremendous mass in spin motion means a tremendous angular momentum. The "principle of conservation of momentum" dictates that when this rotating mass breaks into uncountable clumps, the angular momentum of the single primordial mass of the universe is distributed among all the severed clumps which later evolved to become the rotating stars and the rotating galaxies. As an example, our Sun also received an endowment of the angular momentum from the rotating Golden-embryo, a part of which is exhibited in the form of the Sun's revolution around the centre of our galaxy, once in about 225 to 250 million terrestrial years with a linear speed of about 230 km/sec. A part of the angular momentum inherited by the Sun is exhibited as its spin around its own axis, once in about 25 days. The rest of the angular momentum of the Sun is endowed to all its planets in the form of the spin momentum around their own axes and the angular momentum in their orbits around the Sun.

The proponents of Bottom-up and Top-down theories of the galaxy formation theorize that the angular momentum in the celestial bodies developed some 500 million years after the Big Bang when the galaxies were formed. Contrary to this is the Vedic premise that the rotation in the celestial objects is the endowment of the primordial matter of the universe that led to the formation of the celestial objects and galaxies right from the Vedic Big Bang. Consequences of this for the theoretical physics/cosmology/astronomy and for the practical astronomy are immense. The most impacting consequence of the Vedic principle of the rotating universe is that the universe may not be expanding as fast as suggested by the modern astronomy/cosmology. This is discussed further in the following.

To the best of this author's understanding the rotating universe is the first-time deduction by this author based on the Vedic scriptures, being published in this book.

## Concept of Dark Energy Hypothetical and Unnecessary

Owing to the observed Doppler red-shift in the light spectrum of faraway galaxies the contemporary astronomy has concluded that the galaxies are flying away from each other, expanding the universe. But it has not suggested that the universe could also be rotating. It is the Vedas that stipulate a rotating universe. If the entire universe is rotating around an axis far-far away from the observer on the Earth and if we were rotating with it, the rotation would not be easily discerned. The situation could be similar to a merry-go-round where all horses are rotating around an axis yet althe l horses are seen stationary with respect to each horse.

There are two main factors in the contemporary Big Bang Hypothesis that keep the universe in its present state: the inward pointing gravitational force that keeps the celestial objects attracted together and the outward pointing hypothetical Dark Energy that pushes galaxies outward thus expanding the universe. Since the universe is expanding, the Dark Energy presently dominates over the gravitational force. In a rotating universe, stipulated by the Vedas, the inward force is the gravitational force but the outward force is not due to some hypothetical Dark Energy – it is the centrifugal force of the rotating universe. The centrifugal force in a rotating system is real, pointing away from the axis of rotation and therefore creating the expansion of the universe. The gravitation pulling the matter inwards and the centrifugal force of rotation pointing outwards creates a dynamic equilibrium in the universe. The hypothetical Dark Energy of the contemporary cosmology is **unnecessary**.

What keeps the rotating system going in the Vedic Cosmology? The mechanism for the rotation of the universe is the same that rotates the solar system and the galaxies. It is the rotational momentum acquired by the early universe which is maintained owing to the gravitational field of the universe, in the same way as the Earth continues to rotate around the Sun and the Sun continues to rotate around the axis of the Milky Way Galaxy and the Milky Way Galaxy could be rotating around the presumed axis of the universe.

What is responsible for rotating the *Hiranya-garbh* and what pumps energy into it is revealed by the Veda mantras discussed below.

## Skambha the Pillar of Energy

Two AtharvaVeda mantras are invoked here that relate to two important actions in the primordial universe. One mantra pertains to the impartation of rotation to the primordial Golden-ovate and the other pertains to the impartation of the heat energy to it. Both actions are performed by a single physical structurecalled the *Skambha*. In the colloquial *rudhi* usage the term '*skambha*' stands for a 'pillar'. The *Skambha* in the context of the Vedic cosmology is a supplier of energy to the system of the universe and therefore the *Skambha* is the 'pillar of energy'. What is this mysterious *Skambha* (the pillar of energy), that plays a crucial role in the Vedic cosmology? To the best of this author's understanding of the Vedic science, the answer is furnished in the following.

The two mantras of great significance are the 26th and the 28th from AtharvaVeda's Chapter 10, *sukta* 7. Since these mantras provide specific insight into the cosmological processes in the early period of the universe, their translations along with detailed word meanings are presented. This enables the reader a first-hand visualization of the cosmological actions in the primordial matter-conglomerate that is ready to create the universe. The straightforward English translations based on the *yaugik* meanings (closest to the root meanings) of the Vedic terms in the mantras lead one to recognize the important Vedic science-thought contained in them.

The first mantra (AtharvaVeda, 10/7/26) takes us right into the early moments of creation, stating that the *Skambha* rotated the ovate of primordial matter when the universe was being created.

यत्र स्कम्भ:1 प्रजनयन् पुराणं **व्यवर्तयत्**2 ।
एकं तदङ्गम् स्कम्भस्य1 पुराणमनुसंविदु: ॥
(AtharvaVeda, 10/7/26).

**Transliterationn**:

"*Yatra Skambhah[1] prajanayan puraanam vyavartayat[2] ।*

*Ekam tadangam Skambhasya[1] puraanamanusamviduh* ॥"

**Word Transliteration and meaning:**

यत्र (*yatra*) = there/at that time, स्कम्भ: 1 (*Skambha*) = '*one that supports the existence of the object (structure) it is for*', the pillar, प्रजनयन्

(*prajanayan*) = while giving birth to it / while creating it, पुराणम् (*puraanam*) = ancient/the eternal (cause) / the Nature, **व्यवर्तयत्**2 (*vyavartayat*) = gave rotation around an axis, gave circular motion / gave it a spin ।
एकं अङ्गम् (*ekam angam*) = one limb / one portion / one function, स्कम्भस्य1 (*Skambhasya*) = of the *Skambha,* पुराणम् (*puraanam*) = ancient / the eternal (cause), मनुसंविदु: (*manusamviduh*) = scholarly thinkers know it well ॥

**Mantra Translation:**

*"When this universe was being created, the Skambha*1 *imparted vyavartayat*2*, the spin, to the* पुराणम् (*puraanam = Nature) the eternal-entity. This is the function of the ancient Skambha*1 *that is in cognizance of the scholarly thinkers with high intellect"*. (AtharvaVeda, 10/7/26).

**Mantra Interpretation:**

*Devata*, the subject matter of the 7th *sukta*, is the "*Skambho Jyeshtham Brahmn*". Because the term *skambha* stands for a 'pillar' and the term *jyeshtham* stands for 'the big' or more specifically for 'the elder', the title of the *sukta* in the physical realm means the "*Brahmn's Big Pillar*". The term *Brahmn* throughout the Vedas and the Vedic literature is exclusively for the Creator and the upholder of the universe. Therefore the expression "Brahmn's Big Pillar" for the title of the *sukta* indicates that the mantra's "*Skambho Jyeshtham*" the "Big Pillar" is a pillar-shaped physical structure within the *Brahm-aand* (Brahmn's ovate).

There are two important entities mentioned in the first part of the mantra. The पुराणम् (*puraanam*) meaning 'the ancient' or 'the eternal', which is *Prakriti* (Nature) the "material cause" of the creation. It is addressed as the *puraanam* because in the Vedic science/philosophy the Nature is eternal without a cause for its own existence. It is the same Nature (matter/energy of the universe) that is used for the creation of the universe through its eternal cycle of creation-dissolution (*srishti-pralaya chakra*).

The second entity is the *Skambha* (pillar). Its action according to the mantra is to give **व्यवर्तयत्**$_2$ (*vyavartayat*), the spin to the *Puraanam* (Nature) when it is coming into existence. The term *vyavartayat* stands for a '*circular motion around an axis*' which is primarily the 'spin'. The only mechanism in which a physical structure in the form of a pillar can impart spin to a Golden-embryo of the universe is through the imparting of energy. Therefore the *Skambha* of the mantra is also a "pillar of energy". The mantra establishes that while the universe was being created, it was in a definable physical shape and it developed a rotation around an axis. The cause for this rotation was the pillar of matter/energy the *Skambha*, which is part of the universe and is expected to be centrally located in the Golden-embryo of the universe.

The second line of the mantra reveals that this part (or action) of the *Skambha* is '*in cognizance of the scholarly thinkers possessing high intellect*'. It means that the physical form of the *Skambha* or its action of causing rotation in the primordial universe is comprehended by the scholarly *maatalis* (cosmologists). Some authors, limiting the mantra to the spiritual realm only, have translated the *Skambha* to be the Creator Himself. As mentioned in Chapter 4, the uniqueness of the Veda poetry yields at times the dual meanings of the same mantra, one in the spiritual realm and the other in the physical realm. But in this author's view the subject matter of this mantra is clearly in the physical realm. Whereas a spiritualist would prefer the Creator to be the *Skambha*, the support of the creation, having given the spin to the primordial universe, a physicist on the other hand may view the entire mantra from the physics perspective in which the *Skambha*, a pillar of energy supports the entire universe in rotation. With either meaning of the term *skambha*, the physical action of the *Skambha* to rotate the Golden-embryo stands.

The reason why this author decided that the thoughts of the mantra belong in the physics realm is straightforward. Firstly the mantra relates to the period *when the universe was being created* – a theme in cosmology; secondly the mantra relates to a mechanical action of *vyavartayat*[2] (to give a spin); thirdly the mantras throughout the Vedas state frequently that the Creator is a formless entity and beyond the comprehension of the humans. The second line of the above mantra states clearly that this एकं अङ्गम् (*ekam angam* = one limb/one function) of the *Skambha* is quite well understood by the scholars of this subject. Because the Creator is said to be

incomprehensible fully the *Skambha* cannot be the Creator. The reference in the term मनुसंविदु: (*manusamviduh* = scholarly thinkers know it) pertains to the Vedic *rishis*, sages and specifically the *maatlis* (cosmologists). Also the scholarly thinkers are aware of the fact that one function of the *Skambha* is to provide the **व्यवर्तयत्**[2] (*vyavartayat*) spin rotation to the physical entity, the Golden-ovate. This puts the mantra's thought in the realm of physics. Therefore the *Skambha* in the mantra is to be taken as a physical feature of the universe. When the *Skambha* of this mantra and the *Skambha* in the AtharvaVeda mantra (10/7/28) to be discussed in the following, as well as in several RigVeda mantras, is a physical structure, it is a subject of cosmology. The important cosmological knowledge imparted by this mantra (AtharvaVeda, 10/7/26) is that the ***Hiranya-garbh*** **(Golden-embryo) receives a spin right in the beginning of the creation**.

Now let us look at this mantra (AtharvaVeda, 10/7/26) together with the other AtharvaVeda mantra (10/7/28). The important difference in the two mantras is in the differing actions of the *Skambha* (pillar). Whereas the action of the *Skambha* in the earlier mantra (AtharvaVeda, 10/7/26) is to impart angular momentum (rotation) to the Golden-embryo, the action assigned to it in the second AtharvaVeda mantra (10/7/28) is to inject resplendent heat energy into the primordial universe.

हिरण्यगर्भं[1] परममनत्युद्यं जना विदु: ।
स्कम्भ[2]स्तदग्रे प्रासिञ्च[3]ध्दिरण्यं[4] लोके[5] अन्तरा[6] ॥

(AtharvaVeda, 10/7/28).

**Transliteration:**

"*Hiranyagarbham*[1] *parmamanatyudyam janaa viduh |Skambha*[2]*stadagre praasinch*[3]*ddhiranyam*[4] *loke*[5] *antara*[6] ॥"

**Word Transliteration and meaning**

हिरण्यगर्भं[1] ( *hiranya-garbham*) = to the Golden-embryo, परमम् (*paramam*) = the most high, अनत्युद्यम् (*anatyudyam*) = indescribable, जना (*janaa*) = people, विदु: (*viduh*) = knowledgeable ।

स्कम्भ:2 (*Skambhah*) = '*one that supports the existence of the object*

*(structure) it is for*', the pillar, **तत्** (*tat*) = that, अग्रे (*agre*) = first, ahead of other things, प्र असिञ्चत्[3] (*pra asinchat*) = -amply-injected, amply-saturated with, हिरण्यम्[4] (*hiranyam*) = brilliance, energy, लोके[5] अन्तरा[6] (*loke antara*) = locale interior, interior of the universe ॥

**Mantra Translation:**

> "*Knowledgeable people are cognizant of the most indescribable Hiranya-garbha*[1] (Golden-embryo) *and they know that right in the beginning the Skambha*[2] *pra-asinchat*[3] *(amply-saturated) the Hiranya-garbha*[1] *with the hiranyam*[4] *(the resplendent energy) deep in its loke*[5]*-antara*[6] *(locale*[5]*-interior*[6]*), the interior of the golden-embryo." (*AtharvaVeda, 10/7/28).

The important terms of the mantra are superscripted. The Nature in the previous mantra was addressed in the context of its virtue, पुराणम् (*puraanam*), the 'eternal-entity'. In this mantra the Nature is addressed in the context of its physical attribute, the *Hiranya-garbha*[1] which means a Golden-embryo that represents the primordial red-hot embryonic state of the universe. The other function of the *Skambha*[2] according to this mantra is to inject energy into the *Hiranya-garbha*[1]. The dual action of the *Skambha* relates to two kinds of energies, the rotational energy $\mathbf{E_r}$ to rotate the *Hiranya-garbha* and the capacious heat energy $\mathbf{E_h}$ to increase the temperature of the *Hiranya-garbha*. The two mantras create a vivid picture in the mind, delineating the physical state of the primordial matter which is a rotating unitary system under the dual-influence of a pillar-like physical structure in the centre.

The mantra states that at this moment of the formation of the universe, the primordial matter of the universe is imbued with ample *hiranyam*[4] which means the brilliant energy. The *rudhi* (common) meaning of the term '*hiranya*' is 'gold' and its *yaugik* meaning (root meaning) is 'brilliance'. The suffix term '*garbha*' when taken as a property, means 'pregnancy' and when taken as a noun it means 'embryo'. Therefore, the two terms together in *Hiranya-garbha*[1] stand for 'a brilliant embryo' or 'a brilliant interior' or in common expression, 'a Golden-embryo'. Using the term *Hiranya-garbha*, the mantra adds an adjective to it and states that it is the '*most indescribable*

*Golden-embryo*'. The side-view of the *Hiranya-garbha* with a *Skambha* at its interior is symbolically depicted on the left in Figure 9.1. The *Hiranya-garbha* with full illumination is depicted on the right in Figure 9.1.

A celestial body under its own gravitational attraction renders itself in a spheroidal shape - examples being the Earth a solid spheroid and the Sun a gas giant. But if the celestial object is rotating around its own axis it would develop a bulge at the equator. The degree of bulge depends on the angular momentum (rotational speed) of the body and the state of matter. The shape of the body under the rotation changes from a spheroid to an oblate spheroid (ellipsoid). The cause for the bulge is the centrifugal force created by the rotation around the axis of rotation. The active tendency of the centrifugal force is to push the rotating matter outwards, orthogonal to the axis of rotation, causing the maximum bulge at the equator. For example the daily spin of the Earth has created a bulge at its equator with the equatorial diameter being 42.77 km greater than its polar diameter. Therefore, the Figure 9.1 symbolically represents the effect of rotation on the *Hiranyam-aand* (Golden-ovate). The rotation is shown by the curled arrow around its rotational axis represented by the vertical arrow. The curled-arrow around the axis symbolizes the *vyavartayat*[2] (spin) mentioned in the AtharvaVeda mantra (10/7/26). A counterclockwise rotation in the figure is arbitrarily set in the likeness of the rotation of our solar system when viewed from above, atop the Sun.

The mechanism for the supply of the heat energy $\mathbf{E_h}$ into the interior of the raw material of the universe is in the second part of the AtharvaVeda mantra (10/7/28). The mantra explicitly points to the physical source of the heat energy, the *Skambha*, which injects $\mathbf{E_h}$ into the *loke*[5]*-antara*[6] of the primordial matter of the universe. The term लोके[5] अन्तरा[6] (*loke-antara*) formed with two separate words, *loke* meaning 'in the locale' and *antara* meaning 'interior', has made the Vedic creation scenario explicit by assigning two mechanisms to the *Skambha* **-** imparting the rotation to the primordial universe and injecting ample heat energy '*in the interior locale*'. Without a doubt, the terminology in the above mantra is to delineate the incredible scenario in the creation process. The hot interior suggested by the Veda for the primordial universe is not a far-fetched thought because a hot interior is the nature of most celestial objects, the Sun being one example. Even the Earth is a miniature example of the primordial matter with

brilliantly hot interior that one witnesses when the golden lava oozes out of a volcano; the golden lava is the Earth's *Hiranya-garbha*.

Another important term in the mantra is '*pra-asinchat*$^{3}$'. A deeper meaning of the word *pra-asinchat*$^{3}$ is '*providing the saturating nourishment*', which in the present context also means injecting sufficient heat energy into the embryo of the universe. In the 26$^{th}$ mantra on the other hand the *Skambha* gives a *vyavartayat*$_{2}$ to the primordial mass where the term *vyavartayat*$_{2}$ has no other meaning than '*giving a rotational motion*', which is a straightforward action in mechanics. Therefore, if one keeps the whole process of creation as an exercise in physics without invoking spirituality and without crediting the initiation of the universe to a Creator, the *Skambha* could be treated as a physical entity within the primordial matter of the universe which happens to be the main source of energy and action in the centre of the Golden-embryo. This in Vedic Creation Scenario could be depicted as a pillar-like structure with the brilliance of tremendous energy in it. When the actions are considered simultaneously, it does not matter whether the energy is injected first (AtharvaVeda, 10/7/28) which generates a rotation in the universe or the rotation induces the heat energy in the system (AtharvaVeda, 10/7/26).

Literary analysis of the term "*Jyeshtham*" in the title "*Skambho Jyeshtham Brahmn*" (the title of the AtharvaVeda *sukta* 7 of Chapter 10) leads to an additional thought in physics. The term *jyeshtham* is an adjective to the *Skambha* (pillar), located in the centre of the *Hiranya-garbha* and two actions are assigned to it – creating rotation and injecting energy. The term '*jyeshtham*' means 'big' and more appropriately the 'elder' among younger siblings. Because no term in a Veda mantra is used casually, the term '*jyeshtham*' for a *Skambha* (pillar) makes it imperative that the *jyeshtham* pillar is the first born among the other siblings. When the subject matter is the creation of the universe and there is only one pillar of energy in the Golden-embryo the question begging an answer is - why is this pillar called the 'elder'?

The function of a pillar is to sustain a structure, the universe being that structure in the present context. Therefore, implicit in the adjective "*jyeshtham*" is that this brilliant pillar of matter/energy at the center of the spinning universe is not alone and it is 'elder', the first-born among other *skambha*-siblings (pillar-siblings). The only other pillars in the context of the

creation are those born after the Vedic Big Bang. Thus the *skambha*-siblings are none other than those at the centres of the galaxies that were born later.

**It is wondrous to note that the modern observational astronomy has observed the *skambhas* at the centres of most galaxies!** The modern cosmology has called this phenomenon the 'bar' of a galaxy and the galaxies with such a bar are called the 'barred-galaxies'. Each galaxy has a dense massive rotating centre that plays a vital role in sustaining the galaxy and its dynamics. These bars (*skambhas*) at the centre of the billions of galaxies born later in time are thus the younger siblings to the *Skambho Jyeshtham* the Elder Pillar at the centre of the universe. The reality is that there is a bar (*skambha*) at the centre of our Milky Way Galaxy as well and this bar is rotating at a very high speed around the axis of the galaxy. This will be discussed further in this chapter.

The deductions from the two mantras are: (a) primordial matter, the Hiranya-aand (Golden-ovate) is a voluminous localized three dimensional object, (b) hiranyam the heat energy is supplied by a physical structure at its centre called the Skambha and (c) it is a 'most indescribable Hiranya-garbha'.

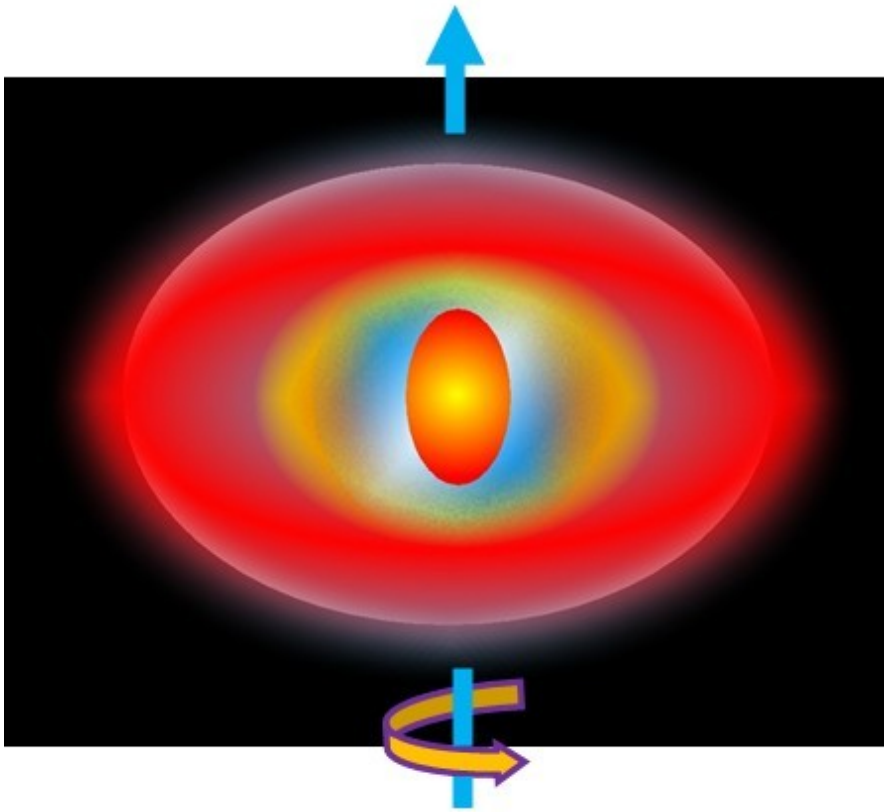

Figure 9.2: A cross-section of the *Hiranyaand* (Golden-ovate) with *Skambha* at the centre. The *pra-asinchan* of *hiranyam*, the injection of brilliantly golden heat energy from the *Skambha* to other regions of the *Maartaand* is shown symbolically by differing colours. The rotational energy $\mathbf{E_r}$ is also developed by the Golden-ovate.

Though these deductions are qualitative in nature they are concurrent with physics and uniquely insightful. The Veda mantras have commented upon the cosmological phenomena, described processes and given well-defined terms of physics. For example the amazing term *hiranyam* for the resplendent energy (AtharvaVeda, 10/7/28) and the term *tapasaha* for the heat-form of energy (RigVeda, 10/129/3, 10/190/1, deductions 9 and 23 discussed in Chapter 6), all bring the ancient Vedic thought extremely close to the modern thought, where the primary actor is the heat energy $\mathbf{E_h}$. These mantras are lessons in physics with a novelty; the novelty being that these lessons were packaged differently and packaged in the distant past. Many *suktas* of the Vedas have invoked the heat energy $\mathbf{E_h}$ as *Agni-devata* and its praise is sung (physical properties recited) in the mantras using differing adjectives. When the matter is ready for creation the *Agni-devata* springs into action starting "….*deep in its loke*[5]*-antara*[6]" (locale-interior).

It is interesting to note the correspondence between the sound and the meaning of the Sanskrit words "*loke-antara*" and the equivalent English words "locale-interior", as if the Sanskrit words were adopted into the English language with minor changes. It is also significant that the Vedic terms are explicit in indicating where in the primordial matter of the universe the heat energy $\mathbf{E_h}$ developed first.

The interiors of all stars and galaxies are the nuclear reactors using Hydrogen as their fuel. The Veda mantra on the other hand stipulates that the *Aapah* (matter in fundamental particles) "*toiled hard*" to develop heat in the *Maartaand*. Also the Vedic philosophy/science stipulates that the atoms and bigger atoms are formed by combinations of fundamental *Aapah*. Therefore, the Hydrogen by Vedic definition is a secondary and coarse stage of the *Aapah-devata*. The heat developed by the *Skambha* at the interior of the *Maartaand* (Mortal-ovate) cannot remain localized; it transmits through the matter of the *Maartaand*. The primary process of heating the rest of the *Maartaand* is the heat conduction from the *Skambha* through the matter of

the *Maartaand*. The other way could be the mini explosions, in the interior of the *Maartaand*. This would be similar to what goes on in the Sun. The occasional solar-flares bursting out of the surface of the Sun begin their journey somewhere deep in the interior of the Sun, transferring heat energy to the intervening matter on their way out. Whatever the method of the heat transfer may be from the centre, through the layers in between and to the surface, it is symbolically shown by the cross-section of the *Hiranya-aand* (Golden-embryo) in Figure 9.2 where the brilliant *Skambha* is depicted at the centre and the layers are shown energized using arbitrary colours.

When the heat energy is developed at the interior locale of the primordial unexploded universe, the expected result is the "*...instantaneous expansion of matter...*" as stipulated in the Veda mantra (RigVeda, 10/129/5, deduction 13 in Chapter 6) which is the Vedic Big Bang. That the heat energy in the Vedic mechanism is developed in the interior locale of the preexisting primordial matter is in variance with the modern Bang Hypothesis. The energy or matter in the space-time singularity of the modern Big Bang Hypothesis is a prerequisite for the big explosion regardless of which locale in the space-time singularity initiates the big explosion.

It is of course meaningless to ask which locale of the space-time singularity gets heated first because by definition the space-time singularity is a dimensionless point without an interior or exterior to it. In physics, the development of heat energy at the centre of a massive body of celestial proportions is automatic under its gravitational pressure. In the case of the Big Bang singularity it would be meaningless to say that the gravitational force existed in it because no forces existed in the non-existent matter in the singularity. Whereas there is no known mathematical basis in the Vedic Creation Scenario for a matter-energy equation of the universe, there is no clarity on the comprehensibility of the nature of energy in the dimensionless Big Bang singularity, in spite of the complex mathematical development in the Big Bang Hypothesis. When it is said in the Big Bang Hypothesis that it was the heat energy in the singularity, it is not clear as to what exactly is the meaning of energy itself in a singularity that triggers the Big Bang explosion at time zero.

The thoughts on cosmology contained in the Veda mantras and in the statements of Shatpath Brahmana cited above are brought together in several depictions as follows.

The second line of the AtharvaVeda mantra (10/7/26), stating that this one part of the universe (एकं अङ्गम् = *ekam angam*) pertaining to the *Skambha* (स्कम्भस्य = *Skambhasya*), something that is well understood (मनुसंविदुः = *manusamviduh*) by the scholarly *rishis*, is no ordinary statement. Something as complex as the universe and within it any observable structure that is not obvious to the unaided human eye is somehow said to be well-understood by the Vedic *rishis*, means that they had considerable supporting knowledge of the observable universe.

The modern astronomers within a few centuries have made progress in leaps and bounds in observational astronomy revealing mysteries of the universe. It is also remarkable that millennia ago this complex phenomenon, the universe, was dealt with by the Vedic *rishis* with amazing depth, perception and detail. They invented the root-based word creation system in Sanskrit language and created the rich terminology for cosmology. The Vedic ideas may not immediately fit into the present reference frame of physics; but they certainly inspire fresh thinking in cosmology and the other branches of science. The similarities and differences between the two cosmologies, such as the expansion of the universe affirmed by the Vedic Cosmology as well as the modern cosmology and the rotation of the universe affirmed only by the Vedic Cosmology, are the opportunities for fresh thinking in cosmological research.

It is mysterious as to how the Vedic *rishis* proposed unexpected mechanisms in the creation process of the universe such as a *Skambha* at the centre of the universe, especially when today's society would consider the ancient societies to be primitive, without advanced instrumentation. Imagining a *Skambha*-like structure at the centre of the Golden-ovate in the Vedic Cosmology is not only unique, it is not an ordinary concept. It is most likely that the Vedic *rishis* arrived at this unique concept of the *Skambha* based on their theoretical studies and on their meticulous astronomical observations.

The proof of this research methodology in the ancient times was presented with several references in Chapters 3 and 5 in Volume 1. The examples include the discussion under the sub-heading "Historicity of River Sarasvati and Astronomy in Mahabharata" in Chapter 3 with reference to Rishi Vedvyas and his astronomy observations around 3140 BCE, the 150 references on astronomy in the book of Mahabharata that modern astronomers have studied and validated, about 70 planetary events with vivid

astronomical observations with accurate records of celestial inscriptions, the rare lunar-solar-lunar eclipse sequence occurring within a period of one month and one lunar-solar eclipse sequence occurring within just 13 *tithis* (lunar days) that are now validated, were all recorded by Rishi Vedvyas. Such records require observation with high precision and a high level of mathematical pre-development for making astronomical predictions. The theoretical and experimental physics of the *rishis* must have been strong. These examples are further supported by over a dozen other references presented in Chapters 5 and 8 such as the measured velocity of light (2202 *yojan* / half *nimesh* = 3.22 x $10^5$ km/sec), "The Mind-Boggling Case of Nimesh" in Chapter 5 and so on.

## Physics and Philosophic Perspectives of the Skambha

There are two basic things associated with a physical object – its physical existence in a given geometry and its properties. Two things come to mind when one thinks of a pillar, a three dimensional physical object pointing vertically upward having the primary property to support something. When one emphasizes the property over the physical form, one is closer to the *yaugik* meaning of what a *skambha* stands for. The *yaugik* meaning (closest to the root) of the term *skambha* therefore is - '*one that supports the* ***existence*** *of the entity (structure) it is for*'. The associated *rudhi* meaning (meaning in common usage) of the term *skambha* would be – '*one that supports the weight of a static structure*'. In the case of a dynamic system, like the solar system, the Sun in the Vedic philosophy is also a *Skambha* because owing to its own gravitational attraction it supports the **existence** of planets revolving around it. The Sun is also a *Skambha* because it supplies the required energy to support the living creation on Earth. The context determines what is being addressed. This little exposé delineates that when the melodious strings of the Vedic terminology are strummed, the beauty of the Sanskrit language begins to resonate!

The *Skambha* in the spiritual realm of the Veda is also the Creator Brahmn for He supports the entire universe and exists as the all-pervading energy that binds the universe together for its existence during the creation phase. The *Skambha* of the AtharvaVeda and RigVeda discussed above is the pillar-shaped central region of the universe, obviously well beyond the limits of practical astronomy, serves as the axle to rotate the wheel of the universe.

The *hiranyam skambhas* (brilliant pillars), the *skambha*-siblings, are at the core of the barred-galaxies.

One observes the symmetry in Nature at all its levels through all scales, minute and astronomical. If there are pillars of energy at the centres of galaxies, why should there not be a pillar of energy central to the universe, supplying the needed energy and dynamics to the machine of the universe? Consider for a moment the early stage of the universe with its matter (galaxies) closer together. The universe at that stage would look like a gigantic galaxy made of future galaxies. Thus it is quite intuitive to think that before the universe expanded to its present state, it was like a galaxy of today in which all stars are bound to its central bulge. The Vedic universe started like a giant galaxy of galaxies and continues to be so in expansion. The question - if each galaxy is rotating around its own *skambha* why would the universe formed of galaxies not be rotating around its own *Skambha* - will remain till proven or disproven.

A positive perspective of the pillar at the centre of the universe is that if the astronomers of today have discovered the pillar-siblings (bars) at the centre of most individual galaxies, someday they will also discover the pillar-*jyeshtham*: the main pillar supporting the universe. A pillar structure at the centre of the universe serving specific functions, as suggested by the ancient *rishis* in the far antiquity of the Vedic Civilization, cannot be put in the category of guess-work because what benefit, material or spiritual, could a *rishi* have derived by proposing such a pillar? When no one can claim yet to have seen the centre of our universe, a central bar (*Skambha*) serving as the axis of rotation for our universe remains a possibility.

Considering what is observed at the centre of the galaxies and in particular at the centre of the barred-galaxies, the subject of the AtharvaVeda mantras certainly remains within the premise of cosmology. The AtharvaVeda mantras (10/7/26, 28) discussed above are two examples out of the 44 mantras with the subject matter of '*Skambha sukta*'. These mantras carry numerous scientific thoughts in the physics realm. Not only the AtharvaVeda mantras but other mantras in the RigVeda also strengthen the concept of *Skambha* as the pillar of energy for the Golden-embryo. It is like one physicist corroborating the findings of another. Let us look at two mantras from the '*Savita sukta*' of RigVeda (10/149/1-2) that recite the virtues of the '*Savita-devata*' and make a reference to the *Skambha*. The term '*savita,* stands for – *one who creates and sustains what is created*. In

the spiritual realm the Creator Brahmn is addressed as *Savita* because the Creator is credited for creating and sustaining the cosmos. In the physical realm the Sun is addressed as *Savita* for it created and sustains the solar system, including the planet Earth. The abridged form of the joint translation of these two successive RigVeda mantras (10/149/1-2) is as following.

> "*Atoorte antariksham* (conterminous Space-entity) *unsupported by the Skambha, yet coexists with the Skambha. The Skambha is enriched with Apaam-napaat, the Indra-devata* (energy in the form of electricity), *the devata who is also a participant in the creation of the spread-out cosmos the Dyu* (brilliant space surrounding the Sun) *and the Earth"*. RigVeda (10/149/1-2).

These two mantras together express thoughts that have direct relevance to cosmology. The Space-entity is addressed with the adjective of *atoort antariksham*. The term '*atoort'* means "*without discontinuity or without holes"* and the term '*antariksham'* stands for the Space-entity, the properties of which were extensively discussed in chapter 5 Volume 1. The modern cosmology may consider the Space-entity ubiquitous but its property of *atoort* in the Vedic definition makes it a three dimensional continuum "*without discontinuity and holes in it*" – a remarkable observation by the *rishi*! Modern cosmologists have used the expression – "iselands of Space". There is no place for iselands of space in the *atoort antariksham* which is a continuum. In spite of the empty space one sees between two trees and one sees the vast emptiness between the Earth and the stars, the *rishis* of the Vedas were cognizant of the fact that the *Antariksh* (Space-entity) pervaded all empty space and was without discontinuity (*atoort*).

Yet another property of the Space stated in these mantras answers the question – what supports the Space? The brilliant *rishi* in the above mantra stated that the *Antariksham* (Space-entity) is a self-supported entity without the need for a *Skambha* (pillar) to support it, yet it coexists with the *Skambha*. The reference to *Antariksham* in these mantras is to provide clarification by the Vedic *rishi* on two mysterious yet co-existent different entities in the creation.

The Veda has stipulated with extreme clarity that all matter of the universe in the form of celestial bodies and energy are embedded in the

Space-entity and are held by it and therefore supported by it. Since the property of a *Skambha* also is to provide support, the *rishi* in these mantras felt the need to differentiate the two entities, both having the common property of 'supporting'. The Space provides the home for the matter of the universe but is not supported by a physical pillar and does not supply energy to the matter that it holds. The *Skambha* of the Veda mantras on the other hand is the source of energy for the matter of the universe, thus providing a different kind of support to the universe. The *rishi* through these mantras is differentiating between the two kinds of supports to the universe – the *Skambha* as the dynamic physical-support to uphold it and provide energy-support to sustain it and the stretchable Space-entity (*Antariksham*) to serve as the container of the universe and all substances there in.

The name of the *rishi* of the *Savita sukta* of RigVeda is Archan-of-Hairanyastoopah, meaning Rishi Archan who has knowledge of the *Golden-stooph* where *stoop* means a pillar (*Skambha*). He has stipulated that the *atoorte antariksham* (conterminous Space-entity) and the *Skambha* do coexist without interfering with each other and are two different physical entities with different constitutions and properties. Also the terms *Skambha* and *Savita* (the Creator) in these mantras appeared in association and succession making it obvious that the two are separate entities. In the physics context the *Skambha* is the supplier of energy to the universe and the *Savita* is the creator and sustainer of the physical system; the physical system being the universe.

*Skambha* the pillar in the context of the creation of the universe is a mysterious physical feature of the Vedic Creation Principle. A part of the mystery is however revealed by the fifth mantra of the same *Savita sukta* of RigVeda (10/149/5) where the two terms, *hiranyastoopah* and *Savita,* occur sequentially, rendering them to stand for two different entities. The term *hiranyastoopah* is a conjoined word of an adjective *hiranya* (energy, brilliance) and a noun *stoopa* (pillar). Therefore, the term *hiranyastoopah* stands for "*the brilliant pillar of energy*"; just another synonym for the *Skambha* (pillar). Thus a *Skambha* in these mantras is a physical pillar of golden-brilliance which is the source of energy, which exerts gravitational force on the entire universe and keeps the universe in rotation with dynamic equilibrium. The process seems to be similar to what is going on in the solar system. The Sun exerts gravitation on all planets and keeps the solar system in a dynamic equilibrium.

For the sake of brevity, the RigVeda mantra (10/149/5) is not presented here with full word meanings and individual word translation, instead, one of its important expressions related to the subject of *Skambha* is presented here which states – "… *the Skambha is the subject of the scholarly angirasas*". Just as the Vedic term for the scholarly in the subject of creation and cosmos is *maatali* (cosmologist/physicist) the Vedic term for the scholarly in the subject of energy science is *angirasa*. When the etymology of the important Vedic term '*Skambha*' is invoked through Yask Rishi's Nirukt Sutra, supplemented with the other commentaries in the Sanskrit Literature and its correlation to other phenomena is researched, one finds that the '*Skambha*' of the Vedas is also said to be "*a pillar stable under Vaayu's harness"*, where *Vaayu* is an inherent property in the universe under the title of the *devata* of kinetic energy that creates dynamics in substances. In the Vedic thought the *Vaayu-devata*, briefly discussed earlier under the sub-title, "The *Vaayu-devata* as Internal Energy: The Latent Kinetic Energy", is the cause for all motions at all levels in the universe. In other words, even the motion created by the gravitational attraction between the Sun and the Earth is credited to the *Vaayu* where its harness is the invisible force of attraction between the Sun and the Earth. The *Vaayu-devata* is also discussed later in this chapter.

The stability of the *Skambha* of the universe under the harness of *Vaayu* therefore means that the *Skambha*, having its relation to *Vaayu*, obviously is dynamic in nature and is also in a stable state at the same time. In physics terminology this is called the '"dynamic equilibrium". This scenario hints at the two actions in two separate epochs of the creation (a) in the Vedic pre-Big Bang epoch the dynamic equilibrium is between the *taapah* the heat energy $\mathbf{E_h}$ causing expansion and the action of being pulled back by the harnesses of the gravitational force and (b) in the Vedic post-Big Bang epoch when the universe is functioning, the dynamic equilibrium is between the centrifugal force due to the rotation of the universe causing expansion of the universe and the action of contraction caused by being pulled back by the harnesses of gravitational force.

This discussion in the Vedic Creation Scenario highlights the geometry of the *Skambha* as an elongated brilliant region in the interior of the primordial universe and its function as a supplier of brilliant energy to the interior of the primordial matter-embryo of the universe. The AtharvaVeda mantra (10/7/28) also states that its energy is enriched in *Apaam-napaat*, the

electric (electrons) form of energy as also stated in the RigVeda mantras (10/149/1-2).

The term *Apaam-napaat* means the "*grand-son of Aapah*". A study of *Indra-devata* from other Veda mantras (e.g. RigVeda, 10/30/4) reveals that the third stage of matter creation out of the most fundamental state of matter called *Aapah* is the electrical energy (electrons). In the Vedic science, the electric form of energy is termed as the *Indra-devata*. Since it is three steps removed from the fundamental state of matter (*Aapah*) the *Indra-devata* is termed as the *Apaam-napaat* - the "*grand-son of Aapah*". An electron therefore is the grand-son of the fundamental matter particle. Rishi Yask's ancient commentary in his Nirukt (3/3/4/16) includes an example from the RigVeda mantra (2/35/10) on *Apaam-napaat*, the *Indra*. The Veda mantras reveal that at the early moments of the the universe's creation, "*the Indra* (electricity) *entered into all substances of the universe creating desired properties in them*". Rishi Yask calls the *Indra-devata* with another adjective also, the *vaidyut-agni*. As mentioned earlier under the sub-heading of "*Indra-devata* as Electricity", the literal translation for the term *vaidyut-agni* is "electric-energy". As we know it now from modern physics, there are fundamental particles of matter called electrons which are the carriers of electric-energy. They are freely available as well as in bound-state in atoms. This is the meaning in the RigVeda mantra (2/35/10) for the expression - *Indra-devata entered into all substances*. Therefore, the *Skambha* seems to be a permanent source of *Indra-devata*, the electric energy, for the universe. Based on the discussion so far, the following conclusions in Vedic cosmology are drawn, which obviously are quite different from those in modern cosmology:

(1) **"*The rotation and orbital motion in celestial bodies is an inheritance from the initial angular momentum of the rotating primordial universe*".** And

**(2) "*The inherent rotational momentum of the universe is the cause for the expansion of the universe and not the hypothetical Dark Energy*".**

Based on the ancient science-thoughts in the Veda mantras these conclusions are new to the modern cosmology and they are strong enough to

generate fresh modern theories of galaxy formation. The Vedic Big Bang process being simple and natural, with the rotational and translational (linear) energies in the system also being natural, the impact of the Vedic thought on modern hypotheses on cosmology could be efficacious.

There is ample evidence in other Veda mantras that along with the heat energy $\mathbf{E_h}$ that developed at the 'interior-locale' of the Golden-embryo of the universe, the rotational energy $\mathbf{E_r}$ also developed when the Golden-embryo went into *paryaplav* (spin in suspension). The net result was the buildup of tremendous universal angular momentum $\mathbf{M_\omega}$. This angular momentum $\mathbf{M_\omega}$ in the rotating primordial universe created the impetuous explosion (*vitatah*) imparting rotational energy $\mathbf{E_r}$ to all breakaway chunks of the universe. The RigVeda's adjective for this impetuous explosion is *vitatah* and this author termed it as the Vedic Big Bang. This conceptual Vedic premise is based on all natural forces and energies – nothing hypothetical!

A modern cosmologist can easily adapt the Vedic scenario into a mathematical model. The theistic component, "Creator's mind over matter" with His *Eekshana* energy triggering the creation could be dropped and only the real physical energies $\mathbf{E_h}$, $\mathbf{E_r}$, $\mathbf{M_\omega}$ and the spinning spheroidal primordial universe could be subjected to a mathematical treatment. Just treat the Vedic Big Bang as an exercise in mechanics. The expected outcome of this exercise should be the physics of the formation of a gigantic spiral galaxy of galaxies. Several more Vedic references are to follow which emphasize that the spiraling universe is the theme of the Vedic Cosmology Principle.

The next step in the Vedic Creation Scenario is the Vedic Big Bang in the rotating hot Golden-embryo the 8$^{th}$ progeny of *Aditi* (Nature) when she hurls the Golden-embryo far-and-wide, spreading it to great distances (RigVeda, 10/72/8). As the other mantra-references have stipulated, this Golden-ovate breaks into uncountable small golden-ovates that are stated to serve as the raw material for all celestial objects of the universe.

After the *Aditi* (*Prajapati*/Nature) in the *Hiranya-aand* (Golden-egg) shape spent one *samvatsar* of 4.32 MY in पर्यप्लव (*paryaplav*) the rotational motion while in floatation developing heat and rotation, as stated in the Shatpath Brahmana (11/1/6/1, 2), it was ready to create cosmos - the population of the *Prajapati* (Nature). The Vedic *rishis* of Shatpath Brahmana and the RigVeda (10/72/2) put a time-stamp of 4.32 MY on *Aditi*'s

pregnancy, at the end of which is born the observable universe. The birth of the universe is the Vedic Big Bang.

Of the seven mantras in the *Bhavavrittam sukta* (History of the Creation of the Universe) discussed in detail in Chapter 6, the fifth mantra (RigVeda, 10/129/5) gives the most vivid description of the Vedic Big Bang stating –

> *"At the onset of creation, there is* विततः (*vitatah*) *the instantaneous-expansion of the rays of* रेतोधाः (*retodha*) *the fundamental seeds of matter, omnidirectional, interlaced transversely all-around, existing above as well as below. These fundamental seeds of matter are the cause for great objects*[1] *of the cosmos…."*

The mantra interpretation in Chapter 6 had led to the three deductions reproduced here:

- (13) The origin of the Vedic universe is in the instantaneous expansion of matter under the Creator's inspiration, the physical form of which according to the RigVeda mantra (1/129/3) is तपसः (*tapasah*), the heat energy.

- (14) The universe is a network of matter with all matter inter-connected.

- (15) The great aggregates of celestial bodies have their beginning from single fundamental particles.

The important phrase in this RigVeda mantra (RigVeda, 10/129/5), as discussed before, is विततः (*vitatah*), the *instantaneous-expansion of the rays of* रेतोधाः (*retodha*), where the plural *retodha* means *the fundamental seeds of matter*. The mantra depicted well the commencement of the event of creation as the instantaneous expansion of the universe, leading to the formation of the cosmos.

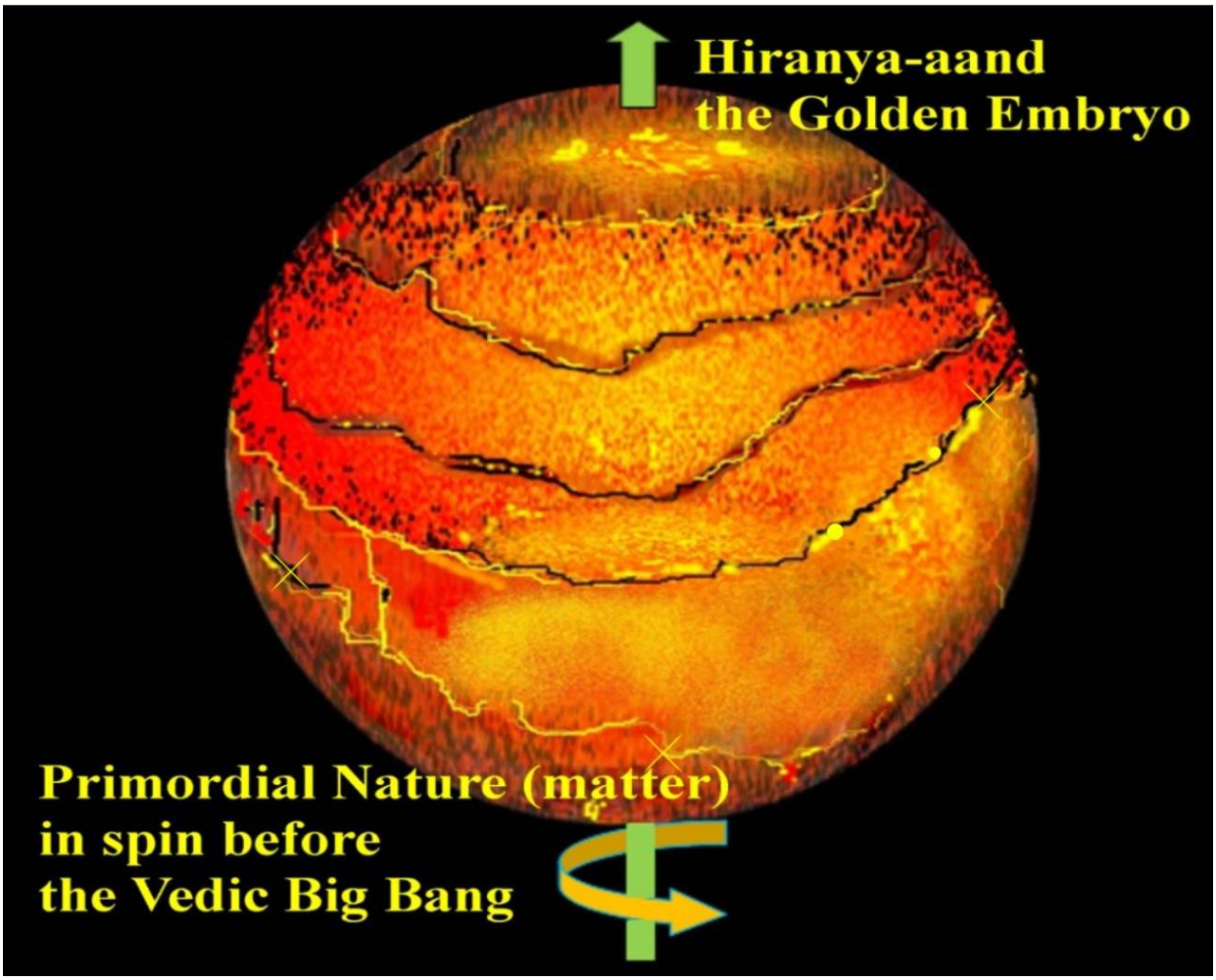


**Figure 9.3:** The *Hiranya-aand* (Golden-embryo) reaches a stage when the built-up interior force is ready to explode it. The cracks in the embryo begin ensuing into the instantaneous expansion.

This mantra required us to develop a scenario of the formation of the universe and its cosmic bodies connectively *interlaced* in a controlled network. Added to this interlacement of matter is the inherent rotation, the *vyavartayat* (spin) to the *Hiranya-garbh* (Golden-embryo) as in AtharvaVeda (10/7/26) or the *paryaplav* rotational motion while in floatation in the *Hiranya-aandam* (Golden-ovate) as in Shatpath Brahmana (11/1/6/1) cited above. Both terms, *paryaplav* and *vyavartayat*, have the same meaning - rotational motion while in floatation which is the spin around an axis as shown symbolically in Figure 9.3.

The two following statements from the last two mantras of the *deva-sukta* of RigVeda (10/72/8, 9) discussed earlier in detail have direct relevance to the Vedic Big Bang:

"*….The Aditi throws its eighth progeny named Maart-aand (in ovate form), far-and-wide, spreading it to great distances.*" RigVeda (10/72/8),

"*…it (Aditi) fills the entire universe with ever-changing mortal-ovates from her eighth progeny named Maartaand.*" RigVeda (10/72/9).

All these mantras along with several other mantras point to the fact that at a moment in time the *Maartaand*, the left-over *Aditi* herself, after creating the 7 *deva*-fields, exploded, throwing the raw material in all directions that formed the cosmos. Describing the event in Vedic cosmology terminology – the *Agni-devata* ($E_h$) was at work over a period of 4.32 MY with the property of *aknopan* to separate the substances, building tremendous internal pressure in the Golden-embryo, in association with the *Vaayu-devata* with the property of motion and dynamics, creating tremendous centrifugal force owing to the long-term *paryaplav (vyavartayat)* rotation of the primordial *Martaand* (Mortal-ovate) leading to the next step in the metamorphosis of the early universe when the first cracks in the colossal *Hiranya-aand* start to appear. This stage is symbolically depicted in Figure 9.3.

The centrally located *Skambha* (Pillar of energy) discussed earlier with other figures (Figures 9.1, 9.2) is hidden inside. Ultimately the Vedic Big Bang eventuates as symbolically depicted in Figure 9.4.

The रश्मि (*rashmi*) of रेतोधा (*retodha*) the 'streams of matter' as stated in the RigVeda mantra (10/129/5), shoot out तिरश्चीन: (*tirashcheenh*), straight in all directions with वितत: (*vitatah*) the instantaneous-expansion of matter. These Vedic thoughts are depicted in Figure 9.4.

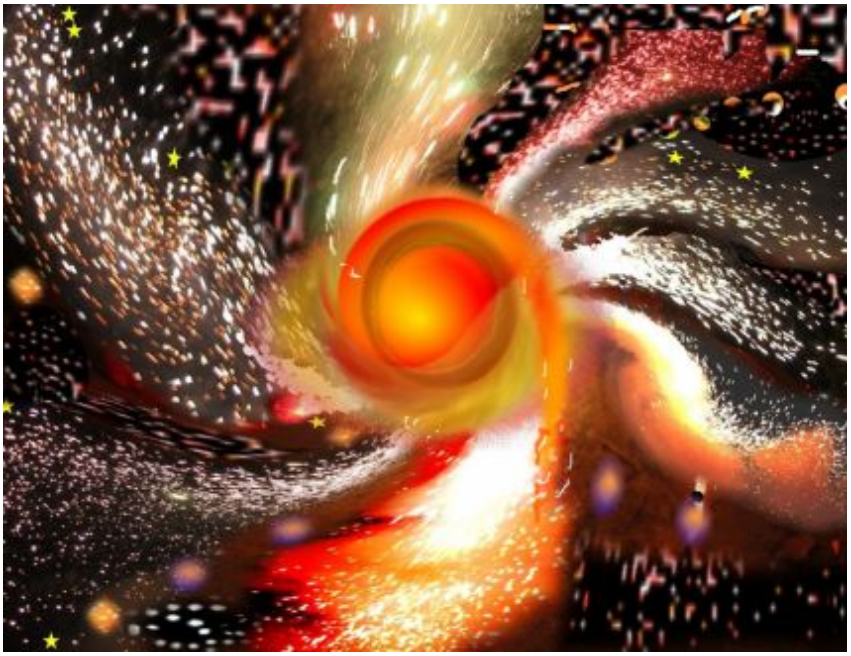

**Figure 9.4:** Symbolic top-view of the universe in Vedic Big Bang taking place in the Golden-ovate, depicting *vitatah* the instantaneous, omnidirectional expansion of the rays of रेतोधा: (*retodha*) the fundamental seeds of galaxies and celestial bodies.

The Figure 9.4 shows the streams of matter-rays flying out in all directions. Each piece in the ray of matter carries both kinds of momenta – the linear and the angular. The linear momentum is along its trajectory and the rotational momenta are of two kinds – one is around its own individual axis of rotation (spin) and the other is around the axis of the universe (revolution) to which all pieces of the disintegrated Golden-ovate are inextricably tied.

*Vitatah* (विततः), the instantaneous-expansion of the Golden-ovate would lead to the separation of matter into irregular conglomerates that the Veda expressed as the pluralized *maartaands*. The primary *Maartaand* is depicted in the Figure 9.3 and the brokenup, pluralized, uncountable *maartaands* are depicted in the Figure 9.4. It was also stated in RigVeda's *Deva sukta* (RigVeda, 10/72/6) that the seven *devas* created as the first seven progeny of *Aditi* are firmly established first in the *Antariksh* (Space-entity) background that is stretched and prepared by the *devas* as the home for the uncountable *maartaands*. All observable matter/energy created in the *Vitatah* (विततः), the instantaneous-expansion in the eighth child of *Aditi* (Figure 9.3), is

immersed in the invisible *deva*-background, not depicted in the Figures 9.3 and 9.4.

The *deva* fields are essential in shaping the universe through the imparting of the necessary physical properties to the matter. The uncountable smaller ovates and the groups of smaller ovates filling the entire universe in all directions are the starting stages of all stars and galaxies. The newly broken off *maartaands*, inheriting the matter, energy, linear and angular momenta from the parent *Martaand* are naturally expected to be made up from minute particles to irregular chunks. The inherent angular momentum and gravitation owing to the mass would initially shape them into oblates (*aandams*), which in time under their own individual *paryaplav* spin must result into flattened rotating galaxies of the universe.

What happens here is a bit similar to the developments in the modern Big Bang Hypothesis, but with many differences; the main difference being the process of the galaxy formation, discussed earlier.

The term "uncountable" in the Vedic Literature is expressed in differing hyperbole. For example in the context of cosmology, the author of the Vishnu-Purana (2/7/27) in one *shloka* (couplet) refers to the uncountable *maartaands* resulting from the Golden-embryo as:

> "*These ovates numbered in sahasranaam* (thousands upon thousands) *and ayutani* (ten-thousands upon ten thousands) *and they were koti-koti-shatani* (hundreds of ten-millions upon hundreds of ten-millions)".

These repeated superlatives of numerals are meant to convey that the *maartaands* out of the single *Hiranya-garbh* (Golden-embryo) were uncountable. A similar expression was used by the author of the Vaayu Purana (49/151) –

> "*Such ovates were in thousands of koti-koti* (thousands of ten-millions upon ten-millions*) and they were at all angles, in horizontal, up and down….*"

This reminds the author of the most beloved professor on TV, Dr. Carl Sagan, who would emphasize that there are "bbbillions and bbbillions" of galaxies in the universe.

The depiction in Figure 9.4 is indicative of the subject matter in the Vedic references. The rays (streams) of matter are symbolically shown in the form of small spheres - bright and dark in different sizes closely packed and moving outwards with tremendous speeds. The Vedic *rishis* have always viewed the astronomical objects as colossal three dimensional agglomerates of matter with the added adjective of *aandam* (ovate) for all celestial bodies.

The streams of matter far-flung in all directions that continue receiving energy from the rotational axis (*Skambha*) of the universe and continue to be tied to it with *Vaayu-devata*'s invisible harness (gravitational pull) would rarefy with time reducing the matter density of the universe. The process would separate the matter into pieces which would serve as the seeds for celestial bodies, stars and galaxies. The rotation and expansion would lead to an overall specific shape of the early universe; the most likely shape being an ellipsoid. Its beginning being in a primordial mortal-ovate, the rotation causing expansion would dynamically continue changing the aspect ratio of the major to minor axes of the ellipsoid, with the aspect ratio much increased with time as the universe flattens out. The rotation throwing the matter outward and the gravitation pulling it back would start to create a dynamic balance in the shape of the universe that could end up in a giant spiral still rotating or the giant spiral degenerating into a rotating wheel. The flattening of the ovate after the initial explosion was inevitable due to the centrifugal force of rotation around the axis of the universe, pushing the matter outward.

There are all indications in the mantras that the central *Skambha* of the universe continues these main actions - it supplies energy and the centrifugal force to the universe by rotating it and also provides the gravitational force on all cosmos to be attracted towards the centre of the universe, thus restraining them from flying away. The *Skambha* at the centre of the rotating universe performs its function in the likeness of the bar at the centre of the rotating Milky Way Galaxy and in the likeness of the Sun, serving as the *skambha* of the solar system for rotating the solar system and holding all the planets from flying away from the solar system.

It is discussed later in the following that the expansion of the universe, which is observed presently, wherein the distant galaxies are observed flying away with increased speeds, could only be an artifact of the rotation of the universe. The universe could be in a dynamic equilibrium, as the solar system is and our Milky Way Galaxy is, with a balance between the outward centrifugal force and the inward gravitational force. Or, if the universe is

expanding it may not be expanding at the rate observed by the astronomers. It also becomes obvious from this Vedic principle that just as one day the *skambha* of the solar system, the Sun, will run out of energy and mass and the central core of the Milky Way Galaxy will run out of its energy, the central *Skambha* of the universe will also get weaker and weaker with time. Ultimately the rotation of the universe could slow down causing a collapse under the force of gravity which would over-ride the centrifugal force of rotation. That would be an event called the *pralaya* (dissolution) in the Vedic terminology. Yes, the Vedas also provide a vivid picture of the fate of this effulgent universe. Before discussing the process of *pralaya* let us bring forward several outcomes and possibilities of the Vedic Big Bang.

## Further Metamorphosis of the Universe – Universe a Rotating One-wheel System

A part mantra from the AtharvaVeda (10/8/7) was presented earlier which stated that "*The cosmos in existence of the entire universe* (observable universe) *is one-half of the whole, then, where exists the other half*". The first part of the same mantra states that the universe is a system like a wheel with all connected limbs, rotating together under the same rule everywhere in the universe. This part mantra is presented in the following with full translation.

एकचक्रं वर्तत एकनेमि सहस्राक्षरं प्र पुरो नि पश्चा । …

(AtharvaVeda 10/8/7)

**Word transliteration and translation:**

एकचक्रं (*ek-chakram*) = one-wheel, वर्तत (*vartat)* = in existence, एकनेमि (*ek-nemi*)= one principle / same principle, सहस्र-अक्षरं (*sahasra-aksharam*) = thousands of non-decaying (celestial) objects, प्र (*pra*)= with specificity/reality, पुर: (*purah*) = forward, नि (*ni*) = with certainty, पश्चा (*pashchaa*)= backward ।

**Mantra Translation**

*"This universe is a one-wheel system in its real existence, with thousands of different non-decaying celestial objects in all directions, forward and reverse, governed by one (same) principle. …."* (AtharvaVeda 10/8/7).

There is no mention of the Creator in this mantra. It is a statement of the facts that relate to the universe as revealed to a Vedic *rishi*. Just as the hub, the rim and all the spokes in a wheel are connected with each other and function together as one system, all the objects of the creation (cosmos), पुर: - पश्चा (*purah-pashchaa*) – "in all directions", are connected with each other and function together as a one-wheel system under "one principle" as emphasized by the term एकनेमि (*ek-nemi*) in the first line of the mantra translation. The term सहस्राक्षरं (*sahasraaksharam*), meaning non-decaying uncountable objects of the universe, is with reference to the stars in unchanging constellations. It becomes clear from this and the earlier mantras, that the universe is a flat and circular, wheel-shaped system, wherein the cosmos are with unchanging positions and the universe has evolved out of a spheroidal, primordial, transient *Maartaand*. All cosmos individually are transient with on-going change in them leading towards their mortality. But as far as it relates to the lifespan of the universe they are अक्षरं (*aksharam*), the non-decaying entities.

A wheel generally is associated with rotary motion around an axis. Therefore, the other implication of this Veda mantra is that the entire universe is in rotation like the joint system of a wheel; something similar to the individual galaxies spiraling around their own axes through their centres. This mantra further substantiates the *paryaplav* rotation of the primordial matter of the universe, developing rotational energy $\mathbf{E_r}$ **,** which in Vedic Big Bang is inherited by all the celestial objects and it persists through the creation. This is a unique Vedic Cosmology Principle.

This Veda mantra did not draw a comparison of the functioning universe with a sphere in rotation, as it does for other individual celestial bodies which in reality are spheroids. In this mantra the emphasis has moved from the sphericity of the celestial bodies, including *Bhoo-gol* the '*spherical-Earth*' and from the spheroidal ovate-shaped *Maart-aand* (transient-egg) to एकचक्रं (*ek-chakram*) the one-wheel system. Therefore, if

the mantra describes the universe here as a one-wheeled system, it implies that the system is in **dynamic stability** with much more spread out in its plane of rotation than in its thickness. This picture therefore would suggest that the universe is more like one gigantic spiral formed by the spiraling galaxies within it.

The observations in applied astronomy reveal that just as the planets in our solar system orbit around our Sun, the other stars have their own planetary systems and their planets orbit around them. A large number of exo-planets are already discovered around many stars in our galaxy. All stars in turn rotate around the centre of their own galaxy. Then it is not inconceivable that the whole universe is rotating like a galaxy around its own single axis, the *Skambha* (pillar of energy). The *Skambha* of the Vedas is the hub that rotates the universe perennially.

This picture of the universe, in the shape of a rotating flattened wheel, is consistent with what one observes as the symmetry in Nature, where everything is spinning and rotating. The flattened Vedic universe has other secondary small flattened one-wheel systems embedded in it in the form of galaxies and solar systems. This drastically departs from the view in the modern Big Bang Hypothesis on the expansion of the universe.

In the Big Bang Hypothesis a force called 'false vacuum' appears during the Cosmic Inflation only once for a period of $10^{-34}$ seconds (ten billion-trillion-trillionth of a second) to accelerate the Big Bang and homogenize the infant universe. At the same time it sets the modes of all the galaxies in that brand-new homogeneous universe. By that is meant - where all future galaxies would be formed. And all this happens practically instantaneously when the infant universe is not even a meter wide. The self-initiated complexity aside the contemporary cosmology ought to make the story of cosmology simpler for a common reader to understand. If not as simple as a rotating wheel of the Vedic Cosmology, it should explain why such a short-lived force of 'false vacuum', created just once in the life of the universe in the exploding space-time singularity, would homogenize the density of the newly born universe? Neither a force of this nature nor a physics process such as the Cosmic Inflation is found to occur in the reality of the Nature.

Contrasting with the modern Big Bang Hypothesis is the Vedic Big Bang Scenario wherein the flattening of the universe is a real flattening as viewed from outside the universe. The influence of the heat energy $\mathbf{E_h}$ with

its inherent nature to expand substances and the rotational energy $\mathbf{E_r}$ generating centrifugal force on the universe would yield a universe that is a flattened rotating disc. All Vedic terms of mechanics such as the **व्यवर्तयत्** (*vyavartayat* **=** rotation around an axis) in the AtharvaVeda (10/7/26) mantra and the पर्यप्लव (*paryaplav = rotational motion while in floatation*) in the Shatpath Brahmana (11/1/6/1, 2), all lead to the forming of a rotating wheel, the universe.

The universe as a 'One-Wheel Rotating System' would drastically change the way the cosmologists interpret the observed red-shift associated with the expansion of the universe. It could revolutionize the way we interpret the rotation of galaxies and the rotation of all other objects of the universe. It could have us reconsider the total angular momentum of the universe and its distribution.

The possibilities are abundant! The most important of all would be a scrutiny of the Dark Energy. Is it real or just a parameter in the Big Bang field equations to yield the desired results? Even though one cannot ascertain where the axis of rotation, the *Skambha* of the universe is, the Veda mantra could certainly inspire one to explore the possibility of assuming the universe to be a wheel-like system, with infinite number of galaxies along the radial directions and uncountable more in the orthogonal space, giving rise to the thickness of the overall wheel. The rotation of the wheel is expected to have loosely bound galaxies in a manner similar to the planets in a solar system and the stars in a galaxy.

As the mantra stated, the only support for this rotating wheel in *paryaplav*, is the "*Antariksh's prashtha*" (on the back of the Space-entity) and therefore it is said to be in stable *paryaplav*. Let us look at yet another RigVeda mantra (7/63/2) from its 63$^{rd}$ *sukta* of the 7$^{th}$ chapter. The *Devata of the sukta* (subject) is "*Soorya*". Therefore all mantras in this *sukta* pertain to the Sun. The mantra tells us that the universe is a wheel-system similar to the solar system. Full translation of the mantra is presented in the following.

उद्वेति प्रसवीता जनानाम् महान्केतुर्णव: सूर्यस्य ।
समानम् चक्रम् पर्याविवृत्सन्यदेतशो वहति धूर्षु युक्त: ॥ (RigVeda, 7/63/2)

**Word Transliteration and Translation:**

उद्वेति (*udveti*) = revealed in the minds of disciplined and enlightened, प्रसवीता (*prasveeta* = female progenitor, जनानाम् (*janaanaam*) = of all humans, महान् (*mahaan*) = great, केतु: (*ketuh*) = self-existent or in existence above all or a symbol of importance, अर्णव: (*arnavah*) = the Space-entity, सूर्यस्य (*suryasya*) = Sun's / of the solar ।

समानम् चक्रम् (*samaanam-chakram*) = analogous to a rotating wheel, परि आविवृत्सन् (*pari aavivritsan*) = repeated motion controlled by circumference or motion confined within a circumference, यत् (*yat*) = that, एतश: (*etashah*) = the special energy, वहति (*vahati*) = flows, stimulates, धूर्षु (*dhoorshu*) = in their axes, युक्त: (*yuktah*) = in union ॥

**Mantra Translation:**

*"The self-existent progenitor (mother) of all humans is t*

*he one who creates and controls the universe which functions in the vast Space* (अर्णव: = *arnavah*) *and remains confined within its circumference* (परि आविवृत्सन् = *pari aavivritsan*), *analogous to* (समानम् चक्रम् = *samaanam-chakram*) *the rotating wheel of the Sun* (सूर्यस्य = *suryasya*). *The special energy* एतश: (*etashah*) *embodied within the axes* (धूर्षु = *dhoorshu*) *of all (celestial objects) is the stimulus to their controlled motion. This is revealed in the minds of highly disciplined and enlightened humans.*" (RigVeda, 7/63/2).

The term धूर्षु (*dhoorshu*) translates into – 'in the *dhoor*' or 'in the *dhoori*'. The *rudhi* (common) meaning of the term *dhoor* is the physical axle of a wheel, which is a substantive object and its *yaugik* meaning (root meaning) is the axis of rotation, which is not a substantive mechanical object. When the mantra is talking about the rotating system of the universe and within it the rotating system of the Sun, it is talking about the axes of rotation. The term *dhoor* (or *dhur*) in the mantra appears in plural representing the axes of rotation of the Sun and the universe, including all celestial objects within the universe. They all function with the principle of rotation around their *dhoor* (axes) and their rotating wheel-like system is similar to the Sun's (समानम् चक्रम् सूर्यस्य = *samaanam-chakram suryasya*). It is obvious from the mantra that the entire universe is a rotating-wheel, spinning around an axis. When conceptualized as an abstract entity, the *dhur* is a conceptual axis of rotation. In the Vedas it is used for celestial bodies like the Sun and in particular for the Earth's spin which is not around a physical axle. Therefore *dhur* is another important term in Vedic mechanics used effectively in Vedic cosmology and astronomy.

The Vedic *rishis* have adroitly used the simile of a cart-wheel for the inherently dynamic celestial bodies. An operating cart-wheel has two motions in it, as in all celestial bodies - the rotational motion around its *dhur* (axle) and the linear motion by which the wheel moves forward. The linear motion in the wheel of a chariot is created by the external power supplied to the wheel by the horse which transforms it into generating the rotational motion around its axle. The *rishis* eons ago observed the two motions in the celestial bodies - the spin around their own axes and the linear motion

around the parent celestial body, the Sun being the parent celestial body for the solar system. Observing this behaviour ubiquitously present at all levels in Nature, they daringly generalized it for all celestial bodies extending from the Earth to the solar system, the galaxy and beyond to the universe itself. Within the mysterious depiction of the above Veda mantra is hidden the valuable observation in mechanics that has now become obvious from the observational astronomy wherein the celestial bodies move around two axes: the axis of rotation and the axis of revolution.

It is also important to note from the mantra that the energy needed for the rotation of the system continuously flows from the system's axis. This energy is termed as एतश: (*etashah*), a 'special' kind. The mantra assigning the adjective of 'special' to the energy, which is transferred to the system through the system's axis, is mysterious because if it were a common form of energy the mantra would have said *taapah* (heat energy). The mantra instead states that this energy is एतश: (*etashah* = special, one of a kind) and created in union (युक्त: = *yuktah*) with the axis (धूर्षु (*dhoorshu*). The mantra also suggests that the universe and the individual cosmos remain confined within their own circumference (परि = *pari*). On pondering over the mantra and analyzing each word carefully the mystery is unraveled. All axes of rotation of all cosmos functioning in union must mean that all cosmic entities are connected to each other and are also connected to the overall rotation of the universe. All cosmos of the universe are kept within the universe's परि (*pari*). Analogous to the objects of the solar system (planets) they remain confined within their circumferences - within the wheel-system.

The term परि (*pari*) is the same as the common term परिधि (*paridhi*) in Indian geometry. It means the circumference. The scientific fact contained in the mantra is that all planets forming the wheel of the solar system, spinning around their own axes, are kept within the circumference of the solar system without losing even one. Also, an individual solar system object moves within its own *paridhi* (circumference). The consequence of the usage of the two words successively, समानम् चक्रम् (*samaanam-chakram* = analogous to a rotating wheel), for a wheel in the mantra is that the same principle applies to the entire universe. This suggests that the universe is a single-wheel system keeping all cosmos in union and confined within their own circumference and within the circumference of the universe.

The first word of the mantra, उद्वेति (*udveti*) meaning - '*revealed in the minds of disciplined and enlightened humans*' (last line in the mantra translation above) takes one to deeper levels of thought. In the spiritual realm the mantra gives full credit to the Creator for creating such a complex and one-of-a-kind system and for revealing it to the enlightened people (cosmologists). In the physical realm one could drop the Creator out of the picture and get a knowledge revelation from the mantra that the universe is a one-wheel system like the solar system where the 'wheels within a wheel' function in union.

Another RigVeda mantra goes a step beyond the above mantra, revealing that the Creator gave a tremendous rotation to the wheel of the universe. Regardless of the theistic Veda giving credit to the Creator, the actual physical process assigned to the Creator is pure physics. The important terms in the mantra are superscripted.

स सूर्यः पर्यु[1]रू वरांस्ये[2]न्द्रो ववृत्याद्र[3]थ्येव चक्रा[4]।

अतिष्ठन्त[5]मपस्यं न सर्गं[6] कृष्णा तमांसि त्विष्या जघान ॥ (RigVeda, 10/89/2)

**Transliteration:**

"*Sa sooryah paryuru*[1] *varaansy*[2]*endro vavrityaadr*[3]*thyev chakraa*[4] *| Atishthantam*[5]*-apasyam na sargam*[6] *krishnaa tamaansi tvishya jaghaan* ॥"

**Mantra Translation:**

*"Like a rotating wheel*4 *of a chariot, Indra the Creator rotated with tremendous speed the wheels of the Sun (solar system) and the other brilliant objects* in a परि[1] अविवृत्यात्[3] (*pari-avivrityaat*) *with* ***non-stop rotation of a system around an axis***. *In the likeness of the same, He rotated the active and the dynamic*5 *sarg*6 *(the universe) with all illuminated celestial objects in it. He thus destroyed the darkness with radiance"* (RigVeda, 10/89/2).

This RigVeda mantra, separated by three chapters from the previous RigVeda mantra, clearly talks about different types of rotating wheels; one kind made up of the planetary system of the Sun and the other one being the rotating wheel of the *sarg*[6] itself encompassing all celestial objects within it.

An important observation from the mantra is that the motion pertaining to the pluralized wheels is the rotation around their axes[1] (परि[1] अविवृत्यात्[3] = *pari-avivrityaat*). The term *sarg*[6], defined in Chapter 5, is for the entire creation, with the added adjective of अतिष्ठन्त[5] (*atishthant*) which means non-static. The term अतिष्ठन्त[5] (*atishthant*) being the antonym of the term तिष्ठन्त (*tishthant*) meaning stationary or non-moving, the author used the term *dynamic*[5] for अतिष्ठन्त[5] (*atishthant*). The *rishi*'s emphasis in the mantra is that nothing in the creation is stationary.

The author wishes to draw further attention to two other important terms in this mantra, the परि[1] (*pari*) and the अविवृत्यात्[3] (*avivrityaat*). Owing to the poetic necessity in the metered mantra, the two terms appear separated but they in fact go together as परि[1]- अविवृत्यात्[3] (*pari-avivrityaat*) which together yield an important expression in mechanics. The term परि[1] (*pari*) by itself stands for "*around on the circumference* (*paridhi*)" and the term अविवृत्यात्[3] (*avivrityaat*) stands for:-

*"the object keeps coming back to the same point owing to its repeated motion on a vritta (circle)*".

The two together therefore define the well-known expression in mechanics – "*repeating circular motion"* or "*repeated orbital motion"*. These expressions indicate the high value of the Vedic cosmology knowledge.

The emphasis in the mantra is that the Creator gave a circular motion to the *sarg*[6] (universe). It is thus implicit here that the spin in the *sarg*[6] was injected right in the beginning when the universe was a primordial ovate. It was discussed earlier as well that the primordial universe received a tremendous angular momentum which is now observed as a ubiquitous fact in the universe, distributed throughout the objects of the अतिष्ठन्त[5] (*atishthant* = dynamic) *sarg*. Based on the AtharvaVeda mantra (10/7/26) and the other mantras under the sub-heading, "Step-3: Heat Energy $E_h$ and Rotational Energy $E_r$ – the Fundamental Tools of Creation", the rotation of the primordial *sarg* was elaborated upon in detail. It is glaringly obvious to those

who know Sanskrit that परि अविवृत्यात् (*pari-avivrityaat*) means - *a* ***non-stop motion around an axis***.

The direct effect of rotation of the universe is the centrifugal force throwing matter to farther distances, exhibiting the expansion of the universe. The rotation also creates a atendency of bringing the orthogonal matter into the plane of rotation. A qualitative side-view of the universe in Figure 9.4 is depicted in Figure 9.5 labeled (A), showing the rotation around the central *Skambha*. Two more conceptual stages of the rotating universe (B, C) are also shown in Figure 9.5.

The rotating ellipsoid of the universe, made up of discrete local spheroids at small scales, will flatten out with time, into a disk formed of flattened galaxies, with each galaxy comprising discrete lumps of matter - the potential stars. The final form of the universe in the Vedic scenario is a flattened disc, which is something similar to the individual common galaxies in the universe. The central bar-structure called *Skambha* (pillar of energy), discussed earlier, continues to be a feature of the Vedic universe.

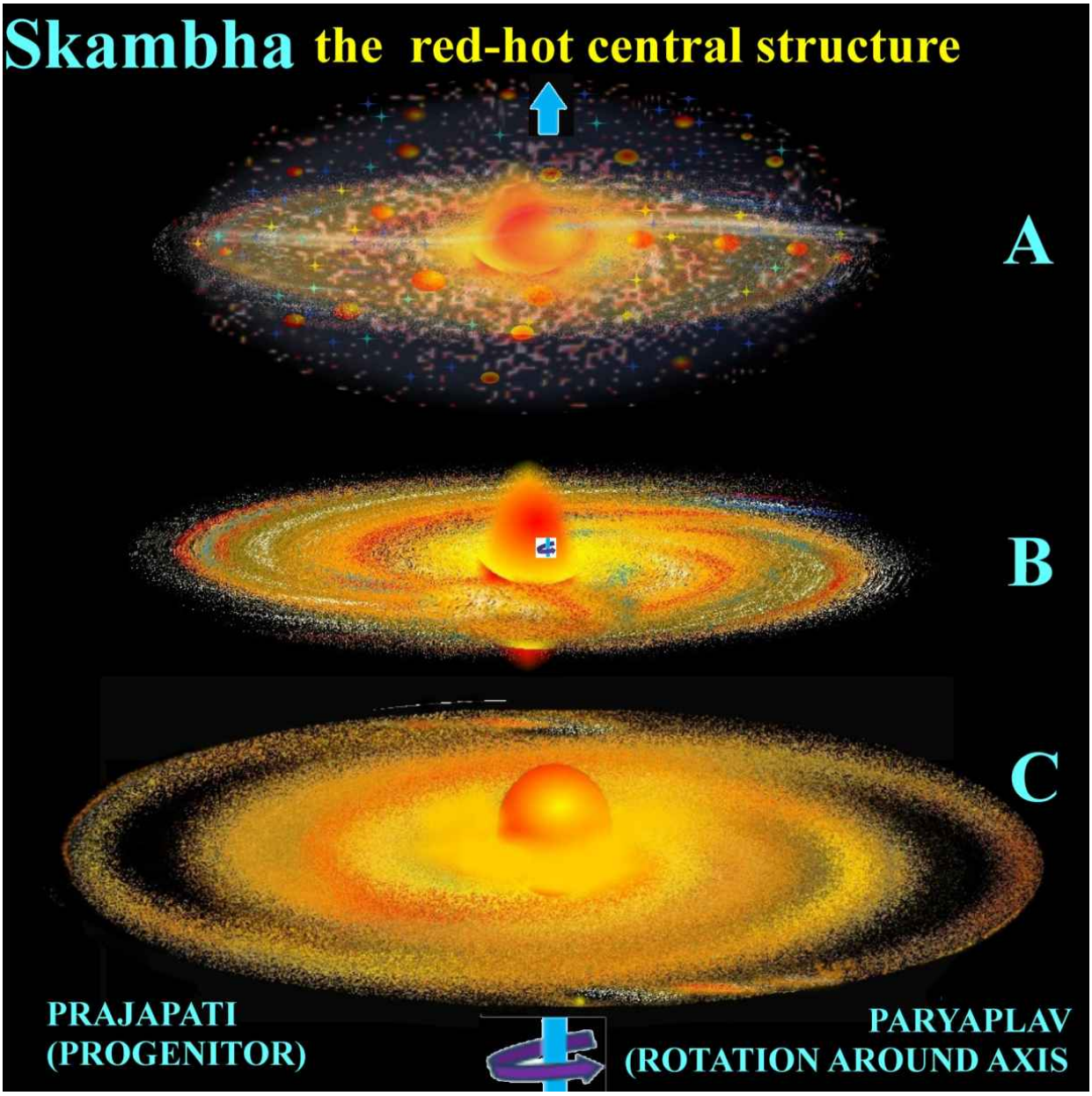


**Figure 9.5:** Side-view of the universe depicting three conceptual stages of the rotating and expanding universe. Each speck in the spiral is a potential galaxy. The seven Deva Energy Fields are part of the Prajapati, not shown separately. The Skambha is shown vertical with extra brilliance at the centre of the universe.

Looking at the successive qualitative depiction of the universe in Figure 9.5, it is intuitive to think and expect in physics frame of reference that the universe created in an explosion, rotating around the massive central core, like in our galaxy, would expand under the centrifugal force, flattening out

into a disc. The modern perspective of the flatness of the universe was discussed in Chapter 2. Some cosmologists rendered an explanation of this flatness to say that the Euclidean Geometry applies to it when viewed from inside the universe. It is another story when one steps outside the universe and looks at its shape. A Vedic universe would be seen as a flat rotating disc. The cause for the flattening of the Vedic universe is its rotation around an axis. The physics fact is that the rotation of a system with non-rigid components would result in flattening and expanding.

The physics thoughts in the Vedic Cosmology Scenario can free the modern cosmology from arbitrarily creating the imaginary mode for flattening (homogenizing) the universe in the hypothetical Cosmic Inflation Epoch and help to better understand - (a) the process of galaxy formation, (b) the rotation in galaxies and celestial objects and (c) the flatness of the universe.

The process of galaxy formation in the modern Big Bang Hypothesis needs a much longer time period to bring back by gravitational pull the matter (Hydrogen and Helium) flying outwards in the ever-expanding universe. In the Vedic Big Bang the matter of the future galaxies is brought together during the incubation period of 4.32 MY when the entire primordial matter acquires tremendous angular momentum. When the Vedic Big Bang takes place the chunks of matter for future galaxies are already together, at high heat and rotation, to take shape quicker.

The process is similar to the formation of the Earth and the rest of the planets from the matter released in an explosion in the Sun. The Earth did not form out of Hydrogen and Helium coming together as proposed for galaxy formation in contemporary cosmology. The hot matter of the primordial matter of the Earth and other planets was already ‘baked’ in the Sun before the mini big bang in the Sun. The principle of the solar system formation in the Vedas, discussed in Chapter 11, is quite similar to the Vedic principle of the formation of the universe. As stated in the RigVeda mantra (4/50/4), Jupiter was born out of the Sun as a brilliantly hot object. Thus, even the galaxy formation process makes better sense in the Vedic Big Bang.

The author has arbitrarily adopted the spiral character into the universe with spiral arms made of galaxies in the likeness of the arms of a common galaxy formed of stars. No physics model was adopted to create these figures; they are merely a conceptual representation of the possibilities in the Vedic Scenario under the Vedic Principle of creation of the universe.

A pillar-like feature in the centre of the universe is symbolic of the *Skambha* of the Vedas, discussed above in detail. A few more comments on it are as following.

# Expanding Universe - a Vedic Discovery Eons Ago

It is remarkable that the several actions in the modern and the Vedic Big Bang are similar, the primary being their beginning with an explosion. One feature of the Vedic principle not found in the contemporary Big Bang is the tremendous rotational energy owing to the *paryaplav* rotation in floatation of the *Maartaand* for a period of 4.32 MY. The cooling of the matter and the process of formation of the celestial objects and galaxies, already impregnated with the rotational momenta, began right after the incubation period of 4.32 MY when the Vedic Big Bang took place. On the other hand the contemporary Big Bang Hypothesis suggests that the rotation in celestial objects that we now see through out the universe developed when they were being formed sometime between 0.3 MY to 1 BY after the Big Bang. Surprisingly the Vedic *paryaplav*-rotation period of 4.32 MY assigned to the primordial ovate falls within the range of the modern cosmology's period 0.3 MY to 1 BY.

If the galaxy formation in the contemporary Big Bang occurred much later, a contemporary cosmologist has to explain why each and every astronomical object, billions and billions of them without any exception, ended up developing tremendous angular momentum. The reality is that even the astronomical systems (galaxies) formed with uncountable objects exhibit a tremendous amount of angular momentum.

Another carefully considered, well-thought-out view of the universe comes from the "*Vishve-deva sukta*" of the 10$^{th}$ *mandala* of RigVeda (10/56). The meaning of the term *Vishve-deva sukta* is - '*the subject of the sukta being vishva the universe*'. Therefore, the mantras in the *sukta* are a well-planned presentation of thought on the universe (*vishva*). A vivid description of the universe is presented in the 5$^{th}$ mantra of this *sukta*, presented below. Like numerous other mantras presented thus far, that rendered the usage of terms in physics and mechanics, this mantra also utilizes terms of mechanics in expressing the science thought on the process of expansion of the universe with the rotation included. For a reader to gain

independent insight into the meaning of the mantra the author has presented in the following the detailed translation of the mantra.

सहोभिविश्वम् परि चक्रमू रज: पूर्वा धामान्यमिता मिमाना ।
तनूषु विश्वा भुवना नि येमिरे प्रासारयन्त पुरुध प्रजा अनु ॥ (RigVeda, 10/56/5)

**Word Transliteration and Translation:**

सहोभि (*sahobhi*) = with its own force, विश्वम् (*vishvam*) = the universe, परि चक्रमू (*pari chakramu*) = rotating repeatedly around an axis, रज: (*rajah*) = observable matter/energy, पूर्वा: (*poorvah*) = previous, धामानि (*dhaamaani*) = places/positions, अमिता (*amita*) = increases/expands, मिमाना (*mimaanaa*) = from minimum, from small ।

तनूषु (*tanushu*) = in togetherness / in assembly, विश्वा (*vishva*) = of the universe/all, भुवना (*bhuvana*) = celestial objects, नि येमिरे (*ni yemire*) = keeps within the rule of Nature/Creator, अनु प्रासारयन्त: (*anu praasaaryantah*) = continually spreads , पुरुध (*purudh*) = diverse, प्रजा (*praja*) = population (celestial objects) ॥

**Mantra Translation:**

> *"The universe (vishva) rotating around an axis (pari chakramu) with its self-propelling force expands greatly (amita) from the previous (poorva) minimum positions of the created celestial objects of matter (rajah). Thus the diverse population of cosmos (praja) of the universe spreads out in togetherness* (अनु प्रासारयन्त: = *anu praasaaryantah*) *bound by Nature's rule"*. (RigVeda, 10/56/5).

The *rishi* of the *sukta*, Brihaduktho Vaamdevyah, expressed the expansion of the universe with remarkable clarity stating that the celestial objects moved away from each other from their initial 'minimum positions' to 'great separations'. Rishi Brihaduktho's mantra is like a page out of contemporary Big Bang cosmology. It is amazing that the thoughts in the

mantra were expressed eons ago in an independent ancient cosmology and yet these ancient thoughts are as modern as they can get.

The *pari chakramu* (rotation) of the entire *vishva* (universe) is a unique and permanent feature of the Vedic creation. The mantra is not talking about the *rishi*'s observation of the night-sky with all the constellations rotating around the observation site on the Earth owing to the Earth's spin because that would obviously be the rotation of the dome of the sky exhibiting no change in the relative positions of the stars with respect to each other in the constellations. The fact that Rishi Brihaduktho talking about is the rotation of the universe with all cosmos separating from each other, away from their previous मिमाना (*mimaanaa* = minimum) closer positions to their अमिता (*amita* = increased) positions. This cannot be based on the nightly observations by the *rishi* because the cosmos do not separate from each other on a nightly basis. The rotation of the universe in the mantra is the rotation of the universe around an axis and the separation of cosmos from each other, increasing their distances, is an additional unique thought in the same mantra.

The separation of *rajah* objects (cosmos) from their previous minimum positions is not an ordinary observation in the ancient astronomy; rather it is the history of cosmology that the Rishi Brihaduktho has deduced. The knowledge of the universe spreading outward, *in togetherness* (तनूषु = *tanushu*), is a unique contribution from the ancient cosmology.

The uniqueness of this mantra in the context of modern cosmology is obvious because its Vedic thought states that the space has expanded since the beginning of the creation. This is substantiated by other Veda mantras. Although one does not observe an ongoing expansion of the solar system presently, it did expand at one time. This thought is specifically expressed with reference to the familiar objects of our solar system – the Sun, the Earth and the *Antariksh* (Space) between them. The RigVeda mantra (10/88/3) states that "…*the specific form of energy named Vaishvanar Agni, had* ततान *(tataan) the Rodasi* (Sun-Earth system) *and the Antariksh* (Space) *between the Sun and the Earth*", where the term ततान (*tataan*) means '*dilation'* (expansion). The expansion of the Sun-Earth system (*Rodasi*) is the subject of other mantras as well extending to the expansion of the universe. The expansion of the universe has been stated in the mantras wirh differing expressions.

There is no dearth of Vedic terms to describe the physical phenomena of Nature, particularly with the appropriate terms in mechanics. For example the terms *paryaplav* and *vyavartayat* appeared earlier are for '*rotation of a body as a whole around an axis*', pertain to large systems of astronomic proportions and therefore relate to cosmology, not to religion or philosophy. A practical example where these terms could be used for terrestrial phenomena is a tornado or a hurricane with a well-defined axis of rotation. Likewise the term *pari-chakramu* indicates that the universe expanded with all its individual objects rotating around an axis and at the same time receding away from each other under the physical law of Nature the नि येमिरे (*ni yemire*). The mantra concludes by saying that this process of expansion of the universe is not a random act; rather it is in accordance with the laws of Nature/Creator.

## The Axial Bars in Galaxies are the *Skambhas* of Galaxies

Considerable discussion on the central, dense, axially rotating core of the universe, the *Skambha*, was taken up in the earlier sections. For the reasons discussed under the subheading "Skambha the Pillar of Energy", the *Skambha* is a physical pillar of energy/mass. The enormous pillar at the centre of the universe is a necessary condition for the Vedic Cosmology Principle because the Vedas have emphasized its presence. In this author's premise the *Skambha* is the central limb of the universe exerting enormous gravitation force to hold the universe together and keep it energized. Since the rest of the systems in the universe - the galaxies, the stars and so on are created in the likeness of the universe with their own dynamic systems they all must also have axes of rotation, the *skambha* of their own. The Sun, as mentioned before, is the physical *skambha*-axis for the solar system.

Several of the AtharvaVeda mantras in the *Skambha sukta* first pose questions asking which parts of the *Prajapati* (the Nature) are occupied by the celestial bodies like the Sun, the Moon and the planets, the region of *Antariksh* (Space) between the Sun and the Earth, the Dyu the brilliant region surrounding the Sun, and so on. Then the mantras that follow furnish the answers. The first part of each mantra of this specific AtharvaVeda hymn on *Skambha* furnishes certain virtues of the universe, related to the creation process and 14 of these 44 mantras end with a statement - '.., *Skambham tam bruhi katamah svived sah*.', which translates into ' .., *the one that has these*

*virtues, you must enunciate it as Skambha with certainty in your voice*.' Therefore, based on the mantras in the *Skambha sukta* of AtharvaVeda and the other Vedas and recognizing the relevance of the mantras to the physical realm, this author's understanding is that a pillar-like supporting structure exists in the centre of the universe.

The Vedic principle stipulates it and the creation-mechanism reveals that the creation of the universe is a 'creation within creation'. A rotating bar-structure (*skambha*) at the centre of a celestial system is a common factor in the universe. All minor creations are in the likeness of the major creation, the universe itself. A bar-structure is a commonly observed feature of the spiraling galaxies, also called the barred-galaxies, including our Milky Way Galaxy, as depicted in the left frame of Figure 9.6. The Sun with its planetary system is situated on the inner rim of our galaxy's Orion Arm, represented by the red dot. Two more examples of differing barred-galaxies are included in this figure. No matter how one interprets the relevant mantras the bar-structure (*skambha*) is an indubitable feature of the Vedic Cosmology. The fact remains that the AtharvaVeda came into existence in the Aryan Civilization eons before anyone thought of or observed a bar-like structure at the centre of a galaxy. The bar-like structure at the centre of a galaxy is not only the most brilliant part of the galaxy but it is also found to be rotating at high speed. An observed feature of the spiral galaxies is that the bar at their centres is densely packed with stars and has extremely hot matter.

**Figure 9.6** (Left) Milky Way Galaxy with the bar-structure at the centre. The Sun's position on one of its arms is shown by S (236080main_milkyway516-NASA). (Middle) Hubble Space Telescope image 2005-01 of barred spiral galaxy NGC 1300. (Right) Sculptor Galaxy, a barred spiral galaxy. Atlas-image (courtesy of 2MASS/UMass/IPAC - Caltech/NASA/NSF).

It seems that most galaxies have their bars aligned in the plane of their rotation which is perpendicular to the axis of rotation. Not finding a suggestion from the mantras about the direction of alignment of the *Skambha* with respect to the plane of the spiral, this author has arbitrarily aligned the axis of rotation with the *Skambha*. Regardless of the Vedic inference that the *Skambha* is perpendicular to the plane of rotation of the universe, it is worth investigating the history of the bar in a galaxy – did the bar in a galaxy begin perpendicular to the plane of the galaxy and fall later on?

The galaxies that do not have a bar at their centre do indicate a bulge of extra matter at their centre. It is possible that over the past billions of years in the life of the universe the galaxies that do not have a *skambha* at their centre did have a *skambha* at one time which ran out of matter and energy. Regardless of what might have gone on in the past the reality of a spinning bar at the centre of most galaxies is remarkably close to what the *skambha* is in the Vedic Cosmology.

One could extend the argument from a galaxy to the entire universe that a bar (*Skambha*) exists in the centre of the universe that drives the entire universe in the same way as the bar in a galaxy. As far as its structure is concerned the central *Skambha* of the universe could be made of galaxies densely packed or it could just a cylindrical pillar of matter and energy. The astronomical survey of the sky shows that the barred galaxies are predominant in the universe and about two-thirds of all spiral galaxies are inhabited by a bar.

The astronomers think that the presence of a bar at the centre of a galaxy plays an important role. On one hand it is said to affect the motion of the stars in the galaxy and on the other hand it affects the galaxy's spiral arms around the galactic centre. The Sun, $2.65 \times 10^{17}$ km from the centre of the Milky Way Galaxy, faithfully rotates around the galactic centre. The other stars on the out-skirt of the Milky Way, at four times the distance of the Sun from the galactic centre, also continue to rotate under the influence of the galactic gravitation. Then it is logical and conceivable to think that an enormous *Skambha* at the centre of the universe, weighing trillions and trillions of galaxies, did for the universe what the bar at the centre of a galaxy does for the galaxy. The *Skambha* under the Vedic Big Bang Scenario imparts energy and angular momentum to all galaxies and the stars within

them, transforming the *Hiranya-aand* (Brilliant-embryo) of the early universe into a gigantic rotating wheel formed of galaxies and stars.

The bar structure in galaxies is thought to be responsible for sucking gas from the spiral arms for fueling the formation of new stars. Thus a bar is a supplier of energy to the new stars of the galaxy. The AtharvaVeda mantra (10/7/28) while interpreting the *Skambha* states, "*…know that right in the beginning the* ***Skambha*** *pra-asinchat (injected)* ***hiranyam*** *(the resplendent energy) deep in its* ***loke–antara*** *(locale-interior)"*. Although the mantras that follow do not suggest that the *Skambha* drew in the gas from the universe for fueling the formation of new galaxies, they emphasize that the bar (*Skambha*) is the source and continues to be the source of energy to the universe. The Vedic universe is a gigantic galaxy of galaxies rotating around the *Skambha*, the massive pillar of energy. The similarities and differences between the modern and ancient scenarios are now obvious and mind-boggling.

Just as the rotating galactic bar at the centre of our Milky Way Galaxy is important without which all the stars would collapse into one blob, the *Skambha* of the Vedas is essential for the integrity of the universe. In the Vedic thought the symmetry in the creation process at all levels is the key to understanding the phenomena such as the *Skambha*. Our Milky Way Galaxy has the major axis of its *skambha* in its plane of rotation whereas the *skambha* of the Sun is orthogonal to the plane of the solar system. Keeping in mind the symmetry as indicated between the wheel of the universe and the wheel of the solar system by the RigVeda mantra (7/63/2), this author chose to have the *Skambha* of the universe along its axis of rotation.

Within the effulgence of the universe one observes that in spite of it being the *vividh srishti* (vivid, diverse creation) there is symmetry at all its levels and as stated earlier in the RigVeda mantra (10/56/5) the universe exhibits the property of तनूषु (*tanushu*), togetherness.

Figure 9.7 symbolically depicts a stage in the formation of the universe with rotation around an axis with the *Skambha* structure in its centre and all galaxies strewn around it, with our Milky Way Galaxy somewhere along a radial direction from the Skambha. The diversity within a given region of the universe is indicated by the granular structure in the gigantic universe with each granule representing a potential galaxy, separated from the next by billions of kilometers. The Milky Way Galaxy in Figure 9.7 is symbolically shown by a small blue dot arbitrarily placed on the rotating and expanding

universe. It is shown amplified in the lower picture wherein each speck represents a star.

These symbolic diagrams exhibit different possibilities in the matter of the rotating universe wherein the rotating universe works like a centrifuge creating an outward tendency in the matter of the universe.

### The "Vedic Cart-wheel Universe" favours the Five contemporary Cosmology Principles

The amazing simplicity of the "Cart-wheel System" of the universe is conducive to the five Cosmology Principles of modern cosmology as discussed in Chapter 2. Since the Vedic universe is a rotating "Cart-wheel System" with all components tied to all other components, the 'Principle of Uniformity' is a natural fit to the Vedic universe wherein - 'The laws of physics … that apply to the observable objects, apply to all objects of the universe.' The same is true for the 'Cosmological Principle' that - 'Except for local irregularities, the universe is homogeneous and isotropic (uniform density).

## Hierarchy in Symmetry in Vedic Universe

The Veda mantras presented thus far, the citations of statements from the ancient commentaries on the Veda mantras, the sutras of the Vedic Darshans (Philosophies) and the interpretation by this author create a vivid picture of the birth and the growth of the universe. The universe in the Vedic Creation Scenario is born out of what is real and available in the universe – there are no hypotheses and premises of the 'universe out of nothing'. It begins with a Big Bang and settles into the hierarchy of rotating celestial systems within systems. This is depicted in the Figure 9.7. The universe in the Vedic concept is finite but infinitely large for humans to fathom completely. It is uniform on a large scale, is a wheel-like system made up of galaxies and is rotating around its own Skambha (axis) in the likeness of a galaxy and all the galaxies are rotating around their own axes within it. As the Veda has put it, this "cart-wheel of the Creator" received its tremendous rotation in the beginning and will rotate perennially till the pralaya (dissolution) and will remain unfathomable in its entirety.

All the stars in a galaxy spin around their axes and revolve around the galactic centre, the Sun included. The planets in the solar system spin around

their axes and revolve around the Sun, the Earth included. The satellites of a planet spin around their axes and revolve around the planet, the Moon included. This symmetry of rotation and spin is the inherent nature of all substances in Nature's creation phase, persisting right down to the inner sanctums of all atoms of all elements, perceptible or beyond perception. The inherent property of revolution and spin at all levels is expressed in Vedic thought as – the *Vaayu-devata* of motion pervades through all matter of the universe.

The symmetry that we are talking about here is not the 'particle-symmetry' a term used in particle physics. This pervading symmetry is in the rotation and spin to which the matter is inherently bound in servitude through the creation phase. The other property of the Nature in its creation phase is the non-interfering hierarchy within this symmetry. That this hierarchy exists, adorned with inherent energy and angular momentum at all levels of creation is the emphasis in the Veda mantras. As depicted in Figure 9.7 the common thread of this hierarchy exists starting from the early universe to the formation of planets.

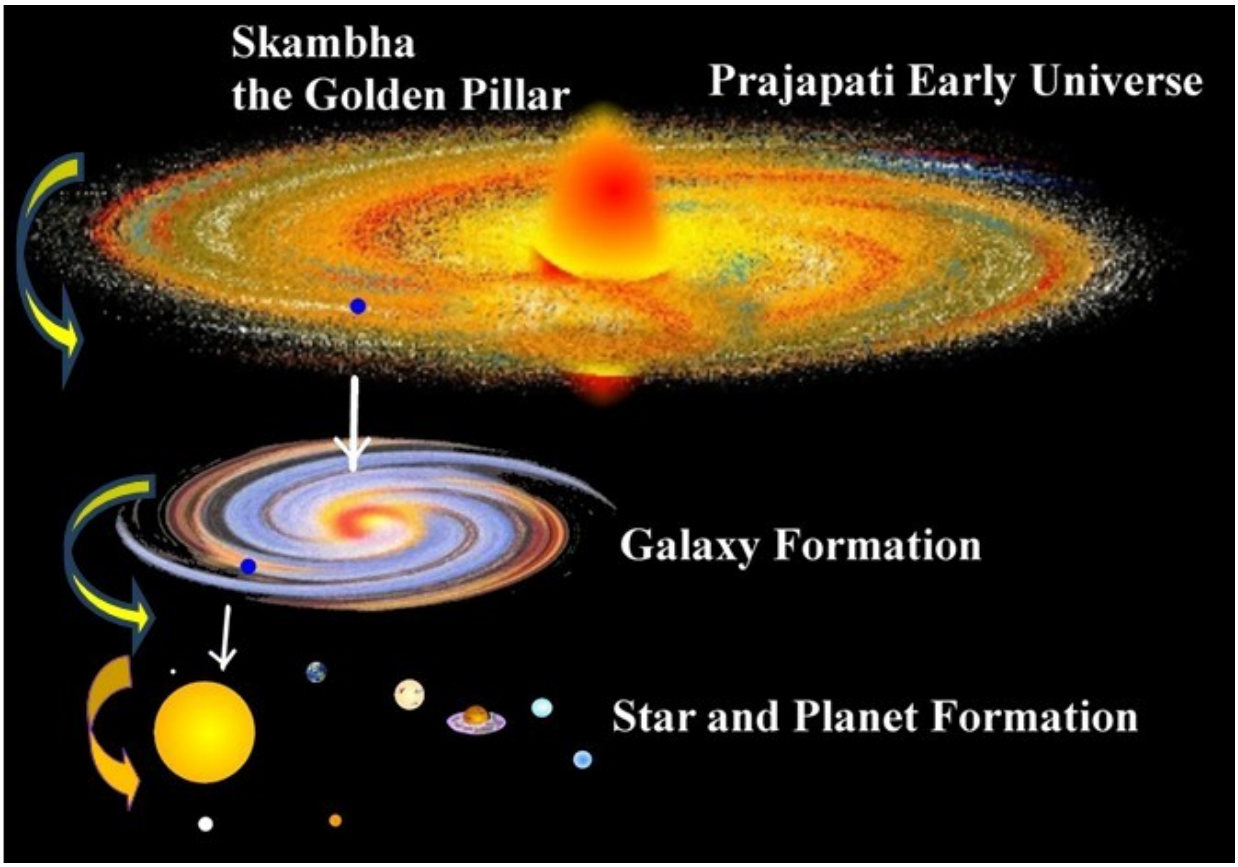

**Figure 9.7:** A conceptual depiction of the top-view of the universe (*Prajapati*) in spiral formation, in *Paryaplav* rotation and expansion. The middle part depicts the expanded view of the Milky Way Galaxy somewhere in the universe (arbitrary) and the lower part depicts the solar system.

If one were successful to add up the angular and linear momenta of all objects of the universe at all levels, one would trace back to the value of the total momentum $\mathbf{M_\omega}$ of the entire universe and therefore the inherent rotational momentum of the Golden-embryo. The Vedic principle of the primordial *Maartaand* breaking into pieces with each piece inheriting the heat and the rotational energy from the total pool of $\mathbf{E_h}$ and $\mathbf{E_r}$ is distinctly different from that prescribed in modern cosmology. From what has been discussed thus far, a general **theorem on matter-manifestation** based on Vedic cosmology could be constructed:

> *"Matter in the creation phase of the universe manifests with the inherent property of motion (Vaayu-devata) which is revealed through rotation and revolution at all its levels and the Vaayu-devata ceases completely in the dissolution phase of the universe".*(Shiv Raj Pal, 2015).

## The Vedic Perspective on Present Theory of Formation and Rotation of Galaxies

The contemporary astrophysics on the formation and rotation of galaxies and stars is a complex subject beyond the scope of this book. However, a brief qualitative discussion on the subject is included here.

According to the Λ-CDM (Lambda – CDM) model of the Big Bang Hypothesis, accepted by most modern Big Bang cosmologists, the galaxy formation begins in the primordial homogeneous universe as tiny fluctuations at quantum physics level when the universe itself was somewhere between trillion-trillion-trillionth of a centimeter to a meter wide. These fluctuations later tend to concentrate matter to form gigantic galaxies. Two kinds of theories for the formation of galaxies: Bottom-up and Top-down are put forward under the Λ-CDM.

In the **Bottom-up** theories the denser points in the fluctuations in the density of the early universe started to gravitate more and more mass as the universe expanded and cooled. The Dark Matter is thought to have played a major role in the process. First the cold Dark Matter clustered which gravitationally attracted the Hydrogen and the Helium; the only gases that existed then. As the universe cooled, Hydrogen and Helium condensed on the Dark Matter that served as the seeds of the first galaxies. Gigantic clumps of condensed molecular Hydrogen and Helium collapsed under their own gravity, fragmenting into smaller clumps. The gravitational collapse released gravitational potential energy as heat. Under the increase in pressure and temperature these gas clumps condensed into rotating spheres achieving a hydrostatic equilibrium forming a proto-star that evolved into a stable functioning star. All the stars thus formed remained gravitationally tied together in a system of millions and billions of stars, called a galaxy. The Dark Matter (non-barionic) without having the property of emitting light is assumed to be present in all galaxies, spread out to sometimes 10 times the diameter of the visible galaxy.

The **Top-down** theories hypothesize that smaller celestial objects such as 'globular clusters' were formed first which attracted each other to form galaxies. In Top-down or Bottom-up theories the basic ingredient for a star and the galaxy formation is the gas-cloud and the mechanism leading to the formation of the stars and the galaxies is the collapse of the gas-cloud under its own gravitation. The gravitational collapse of the gas-cloud produces tremendous heat. In these processes the rotation of the star or of a galaxy could set in later as a result of the convection processes under high pressure and temperature in the collapsed gas that would later condense at the centres of future stars.

The cosmologists have noted several problems with these galaxy formation theories stemming out of Λ-CDM. A natural question is – are Λ-CDM deductions in error or the Big Bang itself is in question? A statement in Wikipedea.org stated,

"*Λ-CDM says nothing about the fundamental physical origin of Dark Matter, Dark Energy and the nearly scale-invariant spectrum of primordial curvature perturbations: in that sense, it is merely a useful parameterization of ignorance*"!

Nevertheless, the three problems pertaining to galaxy formation are listed below under A, B, C examined under the Vedic perspective.

## (A) Younger Galaxies in Better Shape

It is expected that a younger galaxy would be in 'irregular' shape than an old galaxy. In the expanding universe the farther away the galaxy the older it is. The best and the most powerful astronomical instruments enable us to barely view galaxies at a distance of 13.8 billion light-years. This is how far from the Earth they are supposed to have reached since the onset of the Big Bang, 13.8 BY ago and the light from these celestial objects is just reaching us. The astronomical observations of these most distant and old galaxies tell us that these early objects are quite 'irregular' in shape compared to those only 900 MY old, the latter observed to be in well-defined shapes. Therefore the problem with the present theories for the galaxy formation is - why did the celestial objects reach their regular shape within a shorter time in the life of the universe?

## (B) Why Spiral Galaxies still have Arms

The galaxy arms are formed of stars rotating around the centre of the galaxy. It is observed that the inner part of a spiral galaxy spins around its axis a bit faster with the outer spiral arms trailing behind. In our Milky Way Galaxy all arms complete one rotation around its centre in about 250 MY. Almost all of the observed galaxies are older than 2 BY with their arms going around their axes over 8 times. The puzzle before the astronomers is – why do the arms not wind up after a few rotations, leading all galaxies to have uniform distribution of stars in them? Gravitational compression wave theory is suggested to resolve this issue. The inherent centrifugal force in a 'rotating wheel-universe system' suggested in the Vedic Scenario provides a possible answer.

## (C) Merger of Galaxies and the Vedic Perspective

If the universe is the result of the Big Bang explosion in a dimensionless space-time singularity, wherein the matter clumps (stars, gas and dust) fly outward from the point of explosion, moving away from each other, then any matter exchange between the galaxies is counterintuitive. The expansion is supposed to keep the galaxies isolated and separated from each other, yet the astronomers provide observational evidence of galaxy mergers to form larger galaxies.

The nature of all explosions in the created universe is that if the exploding body is not in rotation as in the modern Big Bang, the force of the explosion should throw fragments all around the centre of the explosion, radially directed outwards. The universe in the modern Big Bang Hypothesis is with zero initial angular momentum and the cosmologists using the mathematical setup of the Big Bang Hypothesis simulate a universe with little or no curvature inside it and the Euclidean Geometry applies because any triangle drawn in it would give the sum of the three angles as 180º. Therefore, no heavy mass concentration in specific regions of the universe could exist warping the space-time. Thus, the galaxy-merger seems next to impossible in the contemporary Big Bang Hypothesis.

On the other hand the galaxy merger is a bigger possibility in the Vedic Big Bang wherein all rotating galaxies are part of a gigantic rotating super 'galaxy of galaxies' flying out not along the radial paths but on curvilinear paths. This author suggests one other possibility. The universe may be expanding but may not be expanding at an accelerated rate shown in the observed red-shift of the faraway galaxies. Something else may be causing the red-shift instead. There are other unanswered questions and possibilities not discussed here. Now let us explore some possibilities based on the Vedic deductions.

## Vedic Perspective on Bottom-up /Top-down Galaxy Theories

Keeping the above deductions of modern cosmology in mind, let us invoke the Vedic references that relate to the formation of the celestial bodies and their inherent rotation. There is an intriguing statement in the

ancient Taandya Brahmana (24/11/2) the commentary book on the SaamVeda, (see Bhagvatdatta's comment also, page 323, 1959). The Taandya Brahmana states allegorically–

> *"The Prajapati* (Nature) *created the praja (cosmos). They were not far apart then. They were not accordant. They devoured each other. Prajapati grieved* (chaotic disorder in it) *and foresaw 49 days, after which the process stopped and the cosmos separated from each other…"* (Taandya Brahmana, 24/11/2)

The Taandya Brahmana of Saam Veda, like the Shatpath Brahmana of YajurVeda is also an ageless book. *Prajapati* in Taandya Brahmana is the same as the *Aditi* of the Veda or the *Prajapati* of the Shatpath Brahamana and the Vedas, the Nature itself. The Taandya Brahmana statement is pointing towards the process where individual *maartaands*, the early clumps of matter, devoured each other, something similar to what was said in the context of the modern theory of galaxy formation and merger. The other interesting thing in the statement is that it took 49 *devic*-days for this process to settle, after which the early galaxies receded away from each other. In this Brahmana statement the grief of the *Prajapati* is indicative of the stress on the process of formation of the cosmos wherein the preformed cosmos went into catastrophic events of merger - *they devoured each other*. It is a mysterious statement with not much related explanation to go with it.

The Taandya Brahmana's reference for cosmos to '*devour each other'* cannot be the case of animals because according to the statement, the process of devouring lasted only for a relatively short period of 49 *deva*-days whereas the carnivore animals still continue to have the nature of devouring other animals. The animals have not '*separated from each other'* either. Thus the Taandya Brahmana statement is not a reference to animals, rather it indicates the cataclysmic events when the cosmological objects exhibited violent mergers for a limited period of 49 *deva*-days.

Recall that the Veda assigned a period of one *deva-yuga* of 4.32 MY after the Vedic Big Bang for the order to develop in the creation for life with the root-system to emerge first on terrestrial planets. Regardless of the differing perspective of modern cosmology the 49 *devic*-days assigned by Taandya Brahmana for the cosmos to '*devour each other'* and to '*separate*

*from each other*' equals a time-window of 588,000 human years. This figure being more than half a million years is in the astronomy range. The fact, that there is time specificity for this unusual event to last, indicates that it is an outcome of the knowledge developed by the *rishi* of the Taandya Brahamana.

The situation described by the Taandya Brahmana statement occurred when the universe was still congested with clumps of matter attracting each other and merging to form bigger clumps. Since the time period involved is very long compared to the life-span of the *rishi*, it is not a short-term astronomy observation like observing a supernova explode or tracking a comet in the sky. The Brahmana book's deduction must have been based on some astronomical observations followed by the mathematical calculations where knowledge of gravity was essential. The Taandya Brahmana statement remains a mystery.

This period in the history of the universe was when "*They* (cosmos) *were not far apart then*" and probably when the clumps of matter still existed as smaller *maartaands* yet to transform into galaxies. This could also have been the time when galaxy rotation randomized; some clockwise and others counter-clockwise. Although the Vedic timelines are much shorter than those deduced in modern cosmology, nevertheless they are in million years. The disciplined thought pattern in the Vedic thinking is note-worthy.

## Direction of Rotation of the Universe

A counterclockwise rotation of the universe has been arbitrarily used in all schematics of this book. This rotation is also called the positive rotation in Cartesian coordinate system (x, y, z) where the angle of rotation starts from x-axis and increases towards the y-axis. The counter-clockwise rotation is also commonly known as the 'right-handed rule' (RHR) to describe the rotation of a body where a point on the body moves from left to right, example being the spin of the Earth on its axis. For RHR one points the right-hand thumb upward to represent the North direction (z-axis) and curves the fingers together to represent the rotation of the body from right to left. If one goes high up in space right above the Earth's North-pole and looks down on the Earth one would see the Earth spinning around its axis counter-clockwise.

If one shifts one's location from the Earth to the North-pole of the Sun and looks down on the Sun and the rest of the solar system, one would see that all planets and even all asteroids in the asteroid-belt are rotating around their own axes in a counterclockwise direction and also revolving around the Sun in a counter-clockwise direction. The exceptions are Venus and Uranus that rotate clockwise instead. There are over thirty moons (satellites) of the planets of the solar system that also rotate and revolve counterclockwise with the exception of six that may have been captured by the planets in later encounters. The interesting thing about the rotation and revolution in the solar system is that the Sun itself is rotating around its own axis in a counter-clockwise direction.

The modern theories on the solar system formation suggest that all planets were born out of a single planetary disc of matter separated from the Sun which inherited the rotational momentum from the Sun, causing the entire solar system's counterclockwise rotation. Different zones of the planetary disc at different distances from the Sun accreted forming different planets under the Sun's gravitation. The modern theory of the formation of the solar system, a localized event in the universe, is similar to the Vedic principle (AtharvaVeda, 9/9/8) for the formation of the solar system, discussed in Chapter 8. The same basic process, on an enormous scale, applies to the formation of the Vedic universe as well.

Just as the entire Nature was addressed with the adjective of *Prajapati,* the progenitor and sustainer of the cosmos, the Sun in this localized event is the *Prajapati* the progenitor and sustainer of all planets. It is obvious that the angular momentum in all planets came from their progenitor the Sun, but where did the angular momentum in the early Sun come from? A perspective of the modern astronomy on how a star developed its angular momentum was briefly discussed above. The Vedic cosmology answers this question entirely differently.

The angular momentum in a celestial object, the Sun included, can be traced back to the angular momentum of the primordial Golden-embryo of the universe that developed its *paryaplav* rotational motion over a period of 4.32 MY before the onset of the Vedic Big Bang. It is the inherent angular momentum that leads the matter of the solar system to be confined in a solar disc around the Sun. The fact remains that no celestial body is without the angular momentum. It is becoming convincingly possible that this all-

pervasive angular momentum is an inheritance from the primordial spinning *Maartaand* (Golden-embryo), the material cause of the universe.

The accreted matter that forms a planetary body would have the same direction of rotation as the Sun's direction of rotation (counterclockwise). If two already spinning bodies A and B merge into AB, the law of conservation of momentum requires that the resultant angular momentum of AB be the algebraic sum of the two momenta. Therefore, if both momenta are counterclockwise, the resultant angular momentum is the sum of the two and the direction of rotation would be counterclockwise. If one momentum is counterclockwise and the other clockwise, the resultant momentum of the merged bodies will be the difference of the two momenta and the final direction of rotation will be the direction of rotation of the bigger momentum.

The Vedic universe having its beginning in one gigantic body of matter rotating in a particular direction, counterclockwise in this presentation, is expected initially to produce most galaxies rotating in counterclockwise direction. Observations however show that only about half the galaxies in the observable universe are counterclockwise. How does one explain this discrepancy? The following discussion based on a Vedic reference sheds some light.

## Randomization of Galaxy Rotation and the Vedic Perspective

The time-window of 49 *devic*-days (588,000 human years) cited above sheds some light on this discrepancy. The cosmos according to Taandya Brahmana (24/11/2) "….*were not far apart* and …*devoured each other.* This implies that in this early period of turmoil the universe was small when the raw cosmos merged with each other (*devoured each other*) yielding randomized angular momenta in celestial bodies.

The other plausible cause for randomization of galaxy rotation could relate to the differential rotation of different zones of the rotating Vedic universe, soon after the Vedic Big Bang. When the early universe was small and held tight by its gravity, it rotated around its axis as one body. After the Big Bang, when the universe spread and rotated, it would initially rotate as one body as shown symbolically in part (A) of Figure 9.5. As the time progresses the matter would start to separate into zones with different zones

rotating differentially around their axes, similar to what happened to the planetary disc around the Sun. The differential rotation of the zones is indicated in part (B) of Figure 9.5. The differential rotation of two adjacent rings would create friction in the matter, ensuing accretion of matter into new clumps. The clumps would spin around their own axis clockwise or counterclockwise depending on which clump dominated.

A complete separation of matter from the main spiral and the merging back of the separated matter later is also possible as symbolically shown by the outer arm of the spiral in part (C) of Figure 9.5. The two opposite ends of the arms could merge back with the inner arms. Such mergers of the spiral arms of the universe could create new galaxies following the law of conservation of momentum which sets the direction of rotation of the newly formed galaxy. Thus, in a rotating Vedic universe one does not need two separate Hydrogen clouds to approach and merge to form a galaxy.

## Sustained Dynamic Equilibrium of the Vedic Universe:
## A Tug-of-War between Two Opposing Real Forces

This section deals with the forces that have sustained the Vedic universe in its dynamic equilibrium and will continue to do so in its future till the *pralaya*, which in the Vedic cosmology is a Big Crunch; when matter goes back to its causal state of *Asata*. The term 'Real Forces' in this heading stands for the forces that are not hypothetical like the force of expansion due to Dark Energy in the contemporary Big Bang Hypothesis. The 'Real Forces' are a byproduct of the matter and energy forming the universe. The

dynamic equilibrium of the universe here means the stable functioning of the universe without any sign of chaos, regardless of the present expansion. The Veda considers the functioning universe under a tug-of-war between two real opposing forces, one expanding the universe and the other contracting it. The term dynamic equilibrium may be more meaningful to the Vedic Big Bang because the present expansion could just be a part of the universe's oscillatory nature.

In modern cosmology, two opposing forces are in action to hold the universe together, the gravitational force owing to the mass of the universe which pulls all matter inwards and the unharnessable Dark Energy which pushes it outwards. The modern cosmology has the utmost clarity for the gravitational force created by the property of mass in matter but it does not know with certainty what property of matter created the Dark Energy. Since the universe is presently expanding, the Dark Energy is said to be dominating over the gravitational force.

Surprisingly, the physical perspective for the sustained dynamic equilibrium of the universe is quite similar in the Vedic and the modern cosmologies, but with a difference. Whereas the force of attraction in the two cosmologies is the same, the force of expansion is completely different. This should tickle the imagination of those cosmologists who welcome all new ideas and explore all new possibilities. To explain this aspect of Vedic cosmology, three successive mantras from the AtharvaVeda's *Skambha sukta* in its 10$^{th}$ chapter are presented below. The first mantra emphasizes that the universe (Nature = *Prajapati*) is a **network of cosmos** with all cosmos tied to each other by the invisible force of attraction, the gravitation. The other two mantras emphasize that if the universe is to expand, be sustained in equilibrium or contract, this network of cosmos is to be affected by two opposite forces. Yes, the term used in the Vedas for the physical structure of cosmos-in-togetherness, translates as the '**network of cosmos**'. To alleviate any doubt in the reader's mind that the interpretation of the following mantras could have been something other than this author's, a full word meaning with translation and a brief interpretation is presented. The first of the three mantras is:

यो वेतसं1 हिरण्ययं2 तिष्ठन्तं सलिले3 वेद ।
स वै गुह्य: प्रजापति: 4 ॥

(AtharvaVeda, 10/7/41).

**Word Transliteration and Translation**:

यः (*yaha*) = this, वेतसं1 (*vetsam*) = knitted together, हिरण्ययं2 (*hiranyayam*) = resplendent matter (*cosmos*), तिष्ठन्तं (*tishthantam*) = established well, सलिले3 (*salile*) = embedded in the fluidity of causalmatter (the field of *aapah*), वेद (*ved*) = know it ।

सः वै *(sah vai*) = that itself, गुह्यः (*guhyah*) = mysterious is, प्रजापतिः (*prajapatih*) = *Prajapati*4 , the progenitor of cosmos, the Nature ॥

**Mantra Translation:**

> *"One who knows that all* हिरण्ययं2 (*hiranyayam*) *resplendent*2 *cosmos are firmly established, knitted*1 *together and embedded in the field of Aapah*3*, knows that that itself is the mysterious Prajapati*4 *the progenitor of cosmos"* (AtharvaVeda, 10/7/41).

In the context of *Aditi* (Nature) having its beginning in a brilliantly hot Golden-embryo, the terms such as *hiranyayam*2 for the effulgent matter of the universe have been frequently used in this book. The term *salilam*3 was discussed in Chapter 5 under the Nature-entity and for the Nature's most fundamental form, the *Aapah*[3]. It was also discussed that the term प्रजापतिः (*prajapatih*4) in the context of the physical realm stood for Nature, for it was the procreator of its *praja* (subjects, population) which are the cosmos. Therefore, the mantra has used three forms of descriptive nouns for the single entity called Nature. This alone suffices to say that the emphasis of the mantra is in the realm of the physical creation rather than the spiritual realm preaching about spirituality. It is quite obvious from the mantra that its subject matter is cosmology.

It is also recognized in the mantra that the process of cosmic creation with Nature going through several stages and forms is गुह्यः (*guhyah* = mysterious) and difficult to comprehend completely by the human mind. The mantra reveals that to understand the 'mysterious *Prajapati'* one should understand that the entire universe functions as a single 'web of cosmos' all

knit-together. The term वेतसं॒ हिरण्ययं॒ (*vetsam*1-*hiranyayam*2) means ***"the network1 of resplendent cosmos***2" and nothing else. A natural question is – what is the nature of this network? The answer relates to one of the seven *Devas* created before the observable cosmos appeared.

This *Deva*, as discussed before, is the unobservable tri-property, ubiquitous *Aapah-devata* in the form of fundamental state of matter. All cosmos, also formed out of *aapah*, are embedded in it and everything is embedded in the non-matter Space-entity. It is this field of *Aapah* that initially spreads and stretches the Space-entity creating room for the universe and remains available ubiquitously in the so-called vacuum or emptiness of Space. It is this inert *devata* that remains inter-twined with the inert Space-entity to form the वेतसं॒ हिरण्ययं॒ (*vetsam*1-*hiranyayam*2), the "***network of resplendent cosmos"***. As shown in the *Bhavavrittam sukta* of the RigVeda, presented in Chapter 6, the network of cosmos is not two dimensional like a regular net, it is said to be in all directions. It is a three dimensional 'network of cosmos'.

An important physical property of a net, 2- dimensional or 3-dimentional is that each point of the net is physically connected through all other points on the net and an action at one point of the net is transmitted to all other points of the net. In case of the network of cosmos, each cosmic body is a knot in the net connected with all other cosmic bodies with the invisible thread between each knot; the invisible thread being the gravitational force. It is the ubiquitous *Aapah*-field that connects all the *vetsam*1-*hiranyayam*2 embedded in it. This is equivalent of saying that a force transmitting from one point to the next in space has to go through this field of *Aapah* spread between the cosmos. In simple terms the *Aapah*-field is the medium for all forces. This ubiquitous *Aapah*-field serves as the medium for all forces, electromagnetic (light) or gravitation, that transmit from one point to next through their compression wave. The *Aapah*-field also serves as the viscosity of the socalled vacuum of the Space which puts a alimit on the speed of the force. This is why the light travels in vacuum at a fixed speed of $3x10^8$ m/sec.

## Force Transfer in Vedic Mechanics

The Vedic perspective on how a force transfers from one point to the next was briefly mentioned in Chapter 2, Volume 1. Based on what this

author has understood from the Vedic point of view, all forces recognized in modern physics need a medium and a force-carrier to transfer from one point to another. In the present physics perspective only some forces need a medium to transfer and some forces transfer without a medium. For example the force due to sound vibrations needs an intervening medium (air) in which it creates a compression wave that carries the sound from one point to another. The electromagnetic wave (light) does not create a compression wave and does not need a medium to travel. The electromagnetic force is transmitted by its force-carrier particles, the photons. The electromagnetic wave transmitted by photons travels the fastest in vacuum and according to the general relativity it is the fastest entity in the universe.

The gravitational force, yet another kind of force, is carried by its force carrier particles called gravitons. The force of gravity also does not need a medium to transmit. A natural question arises – why is there asymmetry in force transfer with some forces requiring a medium to transfer and the other forces transfer more efficiently in vacuum?

The Vedic perspective (as this author has analyzed it) is that all types of forces need a medium to transmit. Each force transmits on its compression wave that it creates in the intervening medium. This intervening medium is not necessarily gas, fluid or solid – it is the super minute all-pervading medium called *Aapah*, which as defined in Chapter 5 is the most fundamental corpuscular stage of matter, the last state of matter. In the Vedic perspective the so-called vacuum of space, as between the Sun and the Earth, is not a vacuum. According to the Vedas there is no vacuum anywhere in the universe because where there is no air even that space is filled with the all-pervading *Aapah*-field made up of the most fundamental particles below the size of a quark (discussed in Chapter 5). It is the compression wave created by a photon in this background *Aapah*-field which transmits in the direction of the photon's travel. This is also the reason that a photon acquires and maintains the maximum speed at which it is created in an atom. The photon, a mass-less carrier of *Agni-devata* (heat form of energy), interacts with the intervening *Aapah-devata* field creating in it the compression wave. It is the interaction between a photon (energy, *Agni-devata*) and the *Aapah-devata* (matter) that determines and puts a limit on the speed of the photon. It is the viscosity of space owing to background *Aapah*-field in space that limits photon's speed to $3.0 \times 10^8$ meters/second.

We have learned in modern physics that the force of gravity is created by the mass in a body. A body with mass continuously creates gravity waves that transfer from one mass to another by the force-carrier particle named graviton. The physicists have made efforts to detect a graviton but have not yet furnished positive proof for its existence. In the Vedic perspective of the force transfer the graviton/gravity wave would interact with the intervening *Aapah*-field like a photon. But because it is matter-matter interaction the possibility is that this interaction is more favourable than the photon-matter interaction. The situation is like a resonance phenomenon in physics where there is no change or loss of energy. In this case the intervening medium may not offer any viscosity or it may offer different viscosity from what it offered to a photon. This may cause the gravity wave to travel at higher speeds and possibly at infinite speeds. In other words the effect of gravity could be put under "action at a distance". However, that may not be favourable for detecting a graviton!

The *Aapah* background field is not to be confused with the non-quantized Vedic Space-entity which is also ubiquitous. The Space-entity of the Vedas is only a container of the substances (matter) and is conterminous (*atoort-antariksham*) unlike the quantized *Aapah*-field.

When a light photon travels from the Sun it takes about 8 minutes to reach the Earth but the Earth is under the gravitation field of the Sun (and vice versa) all the time, without an apparent 8 minute delay in the gravitational attraction. Therefore, this author presumed that the speed of the gravity wave must be higher than the speed of light. If the Sun's gravitons took significant time to reach the Earth, like the Sun's photons do, the Earth's orbit governed by the Sun's gravitation, would alter because the Earth's position around the Sun continues to alter. It is this network of the background *aapah* through which the *Vayu-harnesses*, the force of gravitational attraction, reach out to all galaxies right up to the universe's periphery and keep them bound to the universe. The ubiquitous *Aapah-devata* is the unifying field for the electromagnetic and the gravitational forces enabling respectively the photons and the gravitons to travel from one point to the other.

The above discussion under "**Force Transfer in Vedic Mechanics"** is summarized in a theorem:

"*Each force transmits through its compression wave that it creates in the medium which serves as the viscosity for the speed of the force*". (Shiv Raj Pal, November 25, 2017).

Based on the above discussion the placement of cosmos in the unverse could be expressed in a few different Vedic literary vignettes: the cosmos are established in the *vyom* (the Space-entity); the cosmos are established within the uniformly distributed *Aapah*-field; *Dyu*, the region of brilliant space surrounding the solar system is where the cosmos are and the cosmos are held together by the harness (forces) of *gurutva* (gravitation).

In the AtharvaVeda mantra (10/7/41) cited above, the सलिले$_3$ (*salile*) property in the created *Sata*-state of Nature represents fluidity and flexibility. The *vetsam*$_1$- *hiranyayam*$_2$, the '*network*$_1$ *of resplendent cosmos*$_2$' is not a rigid system, rather it is flexible. Consequences of flexibility in the field of *aapah* are immense. The presence of such a background of matter distribution would have an effect on the galaxies. The above AtharvaVeda mantra has explicitly used the term *vetsam*$_1$ for the entire matter of the universe in that the cosmos are tied to each other in a universal web. One could deduce from this network that an action, however minute, at one part of the universe, is felt at all other parts just as in the case of a 2-dimensional as well as in a 3-dimensional net. It is also interesting to note that the gravitational interlacement of the cosmos of the universe is rendered through a unique and simple simile of a 3-dimensional network.

## Two Yuvatis: the Two Opposing Forces

The interlacement of the universe and its functioning is further depicted in a beautiful parable of '*two yuvatis*' in the next mantra (AtharvaVeda, 10/7/42). The colloquial *rudhi* meaning of the word *yuvati* is a 'young woman'. Its *yaugik* meaning closest to the root of the word is, '*one with opposing nature of dissociation and association*' because a young woman dissociates herself from her own family and goes to establish her association with her husband and his family. The energy is also addressed in feminine terms and the '*two yuvatis*' of the mantra symbolize two separate energies. Each of the two *yuvatis* in the parable has the opposing assignation: one has

the force of dissociation (separation) and the other has the force of association (bringing closer). When expressed in physics terms - one *yuvati* (energy) is for the expansion of the universe and the other *yuvati* (energy) is for the contraction of the universe, making them opposing forces. Both these specific processes are explicitly presented in the mantra:-

तन्त्रमेके युवती विरुपे अभ्याक्रामं1 वयत: 2 षण्मयूखम् 3 ।

प्रान्या तन्तूंस्तिरते4 धत्ते5 अन्या नाप वृञ्जाते न गमातो अन्तम् ॥

(AtharvaVeda., 10/7/42).

**Word Transliteration and Translation**:

तन्त्रम् (*tantram*) = web/fabric/netting, एके (*eke*) = single, युवती (*yuvati*) = young woman, विरुपे (*virupe*) = of contrasting beauties / of different nature, अभ्याक्रामं1 (*abbhyaakraamam*) = transgressing each other's territory, वयत:2 (*vayatah*) = knitting the web, षण्मयूखम्3 (*shan-mayukham*) = in the six directions ।

अन्या (*anya*) = one of them / the other one, तन्तून् (*tantoon*) = strands, प्र तिरते4 (*pra tirte*) = spreads, धत्ते5 (*dhatte*) = gathers together, अन्या (*anya*) = the other one, न आप वृञ्जाते ( *na aap vrinjaate*) = do not relinquish and rest, न गमात: (*na gamaatah*) = not going, अन्तम् (*antam*) = up to the end/finale ॥

**Mantra Translation**:

*"Two independent yuvatis (forces) with contrasting beauty and nature, each transgressing*1 *the other's territory engage in the process of knitting*2 *the same web in all six directions*3*. One*

*yuvati* ***spreads***4 ***the strands*** *of the web and the other* ***gathers***5 *them. They do not relinquish their action and rest, yet neither reaches the finale."* (AtharvaVeda, 10/7/42).

This mantra is composed with the '*upma alankaar'* (literary adornment when a simile is used in the poem) where the two young women in the mantra represent two forces (energies). There are several reasons to put this mantra and several more under the subject of cosmology. These mantras are part of the *Skambha-sukta* (*Skambha* hymn) where the *Skambha* is a cosmological entity discussed earlier and the subject of all mantras in this *sukta* ought to be cosmology. Therefore, the two *yuvatis* (young women) of the above mantra must relate to cosmology. The previous mantra (AtharvaVeda, 10/7/41) above makes a reference to the *cosmos knitted together* and this mantra refers to "…*One yuvati* ***spreads***4 ***the strands*** *of the web and the other* ***gathers***5 *them"*, affirming that both mantras are talking about the same web, the web of cosmos. The parable in the mantra emphasizes that the two young women of the above mantra, have opposite properties (with opposite nature) respectively of spreading and gathering the same web of cosmos. Obviously the two *yuvatis* are two opposite physical forces of cosmic nature and not actual human beings. Humans would have insignificant effect on the universe.

These two *yuvatis* are said to be permeating each other and transgressing (अभ्याक्रामं$_1$ = *abbhyaakraamam*) to do and undo each other's action in all six directions (षण्मयूखम्$_3$ = *shanmayukham*). Thus, in the context of the cosmos, the two mystery women of the mantra are two opposing forces in the universe; one causing the expansion (प्र तिरते$_4$ = *pra tirte*) of the universe and the other at the same time causing the contraction (धत्ते$_5$ = *dhatte*). The Vedic simile expresses the two opposing forces as two contrasting beauties (विरुपे = *virupe*) because the beauty of a person is a non-substantive entity like a force.

The usage of six directions in the mantra means that the strands of the net are in all directions. Not having its utility in ordinary life, a 3-dimensional net perhaps was never knitted by humans. Therefore, the two women in the simile of this mantra cannot be real women engaged in spreading and gathering the six-directional net of the cosmos. However, the

conceptualization of a six-directional (3-D) net of the cosmos, with cosmos placed in all directions indicates the advanced thinking by the *rishis*.

The second *yuvati*, gathering back the strands of the cosmic web, is equivalent to a force of attraction that pulls the celestial objects inwards. The force of attraction keeping the cosmos together is the gravitational force owing to the property of mass in matter. Therefore the second *yuvati* is the *gurutva* property of matter, the gravitational force of the modern physics. Neither of these two opposing forces (two *yuvatis*) is yet to reach the final act; the Big Chill when the universe continues to expand or the Big Crunch when the universe collapses into itself. Therefore this author categorized the universe to be in a dynamic equilibrium. When the applied meaning in the Vedic perspective is considered the *yuvati* stretching the net of the universe is the inherent angular momentum in the *Prajapati* (Nature), acquired during its *paryaplav* 'rotation in flotation'.

It is of interest to mention here that the two *yuvatis* are also mentioned in RigVeda's Chapter 1, *sukta* 185 with a depiction different from AtharvaVeda's mantra (10/7/42), yet complementary to each other. The AtharvaVeda mantra uses a different perspective to advance the knowledge content of the RigVeda mantra. It is also of interest to note that the *devata* (subject) of the RigVeda *sukta* being "*Dyaava-Prithvi*", meaning the "*Brilliant space with celestial bodies and the Earth"*, obviously the subject relates to cosmology/astronomy. It is similar to the AtharvaVeda's *sukta* named "*Skambho Jyeshtham Brahmn"*, wherein the subject is cosmology/astronomy. It is also interesting to note that both *suktas* in the different Vedas have enquiring mantras raising questions about the creation. For example, the queries in the AtharvaVeda mantra (10/7/3) are:

*"In which limb of the created universe stays the Earth, in which limb is the Antariksh (Space), in which limb is established the Dyu (brilliant region with celestial bodies) and in which limb is established the Sun and the region surrounding it?"* (AtharvaVeda , 10/7/3).

The RigVeda mantra (1/185/1) of "*Dyaava-Prithvi Sukta"* enquires:

*"O scholarly, who among you has detailed knowledge of which among the Dyu (Brilliant Space with celestial bodies) and the Prithvi (Earth) was created first and which was created*

*after and who knows all aspects of the birth of the proverbial universe wherein exist diverse functions like the day-night in perennial cycle, rotating like the spinning wheel"*. (RigVeda,1/185/1).

Queries about the universe at a preliminary level by Carl Sagan were listed in the beginning of Chapter 1. The queries in the two above mantras in comparison are more specific and go deeper into the subject of cosmology. The style of the mantra, asking questions, implies that the scholarly intellectuals developed detailed aspects of the knowledge of the universe including what is created after what and where in the universe. Whereas the AtharvaVeda mantra enquires about the spatial placement of the cosmic entities the RigVeda mantra enquires about the time sequence (history) of the creation of the same cosmic entities.

The fifth mantra of the *Dyaava-Prithvi sukta* of RigVeda (1/185/5) also talks about *two yuvatis*, but in the Earth-Space context. This RigVeda mantra is remarkably beautiful, expressing the permeation of the two different forces into each other, with the simile of two different fragrances permeating through each other. The translation of the mantra is as follows.

*"The two yuvatis, like the two young sisters (jami) in the lap of the pitro (progenitor = Prajapati = Nature), permeating like two different invisible fragrances, protect us from disorder in the Dyaava-Prithvi (system of Brilliant Space and Earth) by tying it to the bhuvanasya–naabhi (universe's centre of attraction), while obeying their individual principles"*. (RigVeda, 1/185/5).

Once again the mechanisms that keep the universe orderly by keeping a dynamic stability are the two forces that are tied to the focal point of the universe (*bhuvanasya–naabhi*). This focal point obviously is the spinning *Skambha* of the universe around which the universe is rotating.

All motions in the Vedic reference frame are credited to the *Vaayu-devata,* the fourth in the list of *devas* presented earlier in Chapter 8. By that is meant that the kinetic energy in a system owing to motion in the system is the *Vaayu-devata*. Before discussing the interaction between the two *yuvati* forces, a brief commentary on one *deva* converting into another is presented.

# Practical Aspect of the *Devas* - the Energy Fields

Two ancient scholars of thermal physics, Acharya Shaakpooni and Acharya Sthaulashttheevi were referred to earlier from the ancient book of Nirukt (5/1/3/1) authored by *rishi* Yask. The *aknopan* (अक्नोपन) property of the *Agni-devata* (heat energy), $\mathbf{E_h}$, that creates '*separation in substances*', was highlighted in the context of the sudden expansion of the primordial matter leading to the Vedic Big Bang. The Nirukt *sutra* (7/4/1/1) provides further discussion on the properties of the *Agni-devata*. It concludes that all *devatas* of the physical realm are convertible into each other.

These science thoughts are from the ancient Vedic period eons before the beginning of the science enlightenment era in Europe. This means that during that ancient period they were enlightened to treat heat as a form of energy and therefore as a subject of study. Based on the Veda mantras they termed the heat energy (*Agni-devata*) as a '*primary creator of the universe*'. Their awareness of the *Agni-devata* creating the *Vaayu-devata* of motion in substances and other phenomena in Nature is not a surprise but a meticulous progression of their science knowledge.

Rishi Yask in the "*Daivat Kaandam*" (Chapter on *Devatas*) in his book of Nirukt states a *sutra* (7/1/5) in the context of creation that ascribes the canon on the action of the *devatas*. With specific reference to the *devatas* in the physical realm - *Aapah* (fundamental matter), *Agni* (energy, heat), *Vaayu* (motion and action), *Indra* (electricity) and *Som* (chemical bond energy), he stated his three principles of physics applied to the created physical universe. They are as follows (from Sanskrit text to English):

1. *"Devas are born amongst themselves and one can be the cause for the other"* - conservation of *devas*.
2. *"Devas are to enable karma by conscious beings"*
3. *"Devas are self-generated entities"*

This means that the *Vaayu-devata* (force of motion) could emerge out of the transformation of another *devata* or out of the interplay of *devatas* such as *Aapah*, *Agni* or *Indra*. This in modern physics terminology is "*conservation of devatas*". In the Vedic thought the *aapah* are treated as the fundamental particles of matter and therefore the cause for substantive

matter. Thus, under Rishi Yask's rule (1) the matter is convertible to equivalent energy and vice versa. Equivalent of this in modern physics is Einstein's mass-energy equation $E = mc^2$ where E, m and c respectively are energy, mass and the velocity of light. Obviously the Vedic thought behind the above three rules of Rishi Yask is extraordinary.

Now, let us see how this relates to the two *yuvatis* in the mantra from AtharvaVeda (10/7/42) where "*one yuvati* ***spreads the strands*** *of the universal web and the other* ***gathers*** *them together*.

*Devatas,* the first creation of *Aditi* (Nature), are an inherent property of the functioning universe. They pervade all space of the universe in one form or the other. According to Rishi Yask's above mentioned rules they transform into each other to exhibit their presence in specific forms and phenomenon. For example the *Agni-devata* (heat-energy) owing to its property of *aknopan* (अक्नोपन) causes "*separation in substances*" generating the *Vaayu-devata* of motion in that substance because it also has the property of *itaat* (इतात्), '*one that creates motion*' in substances.

This is explicit in the large scale observable dynamic and effulgent phenomena like the galaxies and planetary systems where both these *devatas*, the *Agni-devata* (heat-energy) and the *Vaayu-devata* (of motion) are seen in action. On the other hand the *Vaayu-devata* is also working implicitly through a tiny electron in perpetual motion around the nucleus of an atom at the sub-microscopic levels. All Vedic *Devatas* may not be substantive but they all are real entities. Therefore, the expansion and contraction of the universe in the Vedic Big Bang are caused by real entities. The *Aapah-devata* according to the mantras appeared first as a blob of matter in the *Sata*-state of matter, which '*toiled hard*' for over 4 million years to develop the *Agni-devata* (heat energy) within it. Then, because the *Agni-devata* has the property of *aknopan* (अक्नोपन) to cause *separation in substances*, coupled with the property of *itaat* (इतात्) to *create motion* in substances, the *Vaayu-devata* of motion appeared in the primordial matter of the universe creating the *paryaplav* - "*rotation while in floatation*". The next action in the early universe was the *vitatah*, the *sudden expansion* (big explosion) in the *Hiranya-aand* (Golden-ovate) that was also elaborated upon based on the mantras in the *Bhavavrittam sukta* and other Vedic references. Thus, contrasting with the hypothetical Dark Energy of the modern Big Bang

Hypothesis to expand the universe, the Vedic thought purports the interaction between the real entities and their real effects.

It is in the book of Maaddhyandin Shatpath Brahmana that one of the most ancient *rishis*, well-revered and well-known in the Vedic literature, Rishi Vaajsaneha Yaagjyavalkya, provides an enlightening interpretive commentary on the first mantra of the third Veda, the SaamVeda. This mantra - "अग्न आ याहि वीतये …" (*Agna Aa yaahi veetaye…* SaamVeda (1/1/1) is also the 10th mantra of RigVeda's Chapter 6, *sukta* 6 (RigVeda, 6/16/10). Rishi Yagjyavalkya's interpretation of this mantra is enlightening and draws the reader close to cosmology. He emphasizes that when this mantra is recited to invoke the *Agni-devata* (heat energy) at the time of *yagjya* (fire-oblation), the mantra recitor is reminded of the history (mechanism) of the creation of the universe. He presents the commentary on the mantra in a narrative parable. Only a short relevant part of his narration is presented here (Shatpath Brahmana,1/4/1/22):

"*Now, one says O Agni (heat-energy) come for the* ***growth of the yagjya*** (a selfless act), *for its* ***augmentation*** *or for its* ***expansion***. *Earlier, all cosmos were close together. We could touch the Dyau (brilliant space) like this* (with stretched arm - a hyperbole)!"

The *yaugik* meaning of the Vedic term *yagjya* is a "*selfless act for the benefit of the others*". In many mantras and the Vedic interpretations, the creation of the universe is termed as the "*yagjya* of the Creator" for the benefit of the conscious-beings. To take birth in a physical body and have the opportunity to do karma are for the benefit of the conscious-beings. The fire-oblation by humans is also termed as the *yagjya*, albeit at a miniscule level compared to the creation of the universe. It is *yagjya* because the aim of a *yagjya* is to perform a selfless act in association with others for the benefit of the society. To explain what benefits the humans receive from a *yagjya* (fire oblation) is beyond the scope of this book. However, the *Agni* (energy, fire) is the common factor in both *yagjyas* – the Creator's *yagjya* uses energy to create the universe and the humans' perform *yagjya* with fire. Rishi Vaajsaneha Yaagjyavalkya's commentary on the mantra on *Agni* (energy) reminds a performer of the importance of *Agni* – that it is this *devata* that initiates the creation. The Sanskrit root word '*agranee*' meaning "*the first among others*" leads to the formation of the word *agni*.

In the above statement Rishi Yaagjyavalkya emphasizes that the *Agni*, the radiational heat energy, $\mathbf{E_h}$, was the cause for the ***growth of the yagjya,*** its ***augmentation*** and for its ***expansion***. It is therefore a real physical energy. The other associated forms of real energies such as the kinetic energy (*Vaayu*) in the form of linear and rotational motions generated by *Agni*, together propel the universe and cause its expansion. All these forms of energies in the Vedic reference frame are similar to those in the modern physics reference frame. They all are well-known, measurable and harnessable unlike the assumed Dark Energy of the modern Big Bang Hypothesis.

The deeper meaning of the mantra (SaamVeda, 1/1/1) is that by reciting it and meditating upon it one is reminded of the mechanism of the creation of the universe. The purpose for the invocation of *Agni* through a mantra is to enhance the intellect of the mantra-recitor with the knowledge contained in the mantra rather than invoking *Agni*'s soul. In the Vedic thought, the physical *Agni* that is observed in the form of fire or felt in the form of radiation is an inert entity without consciousness or a soul in it.

The above statement expresses with certainty that the early universe was small with the cosmos close together, same as in the modern Big Bang Hypothesis. According to the Veda mantras and the Brahmana commentary, the heat energy expanded the universe. Rishi Yaagjyavalkya's expression in the statement given above – "*We could touch the Dyau (brilliant space with cosmos) like this"*! indicates that he was in the presence of his disciples and hyperbolizing his narration on cosmology by stretching his arm in the air. The important fact to note from what he said is that – "*Earlier, all cosmos were close together*".

Motion is the net result of an expansion. Therefore, the *Agni-devata* is transformed into *Vaayu-devata* which is discerned as the motion in the universe through its observable matter. This is why the equivalence between the *yuvati* expanding the network of cosmos and the *Vaayu-devata* (kinetic energy) has been drawn in this text.

The expansion of the universe under the Vedic scenario is more probable than under the modern Big Bang with the hypothetical Dark Energy, the creation mechanism of which is riddled with uncertainties. The *yuvati* of the Veda mantra gathering the cosmic web is the gravitational force, same as in the Big Bang Hypothesis. This author emphatically asserts this because as discussed in the earlier chapters, '*gurutva*', the gravitational

force was recognized to be a real force by the Vedic *rishis*. In the case of the Vedic principle therefore, the two *yuvatis* of the mantra belong to the opposing centrifugal and centripetal forces in a rotating body, one owing to motion and the other to gravitational attraction.

The parable of the two *yuvatis* can also be applied to the third level in the hierarchy of creation (after the universe and the galaxy) such as our solar system where the centrifugal force on the Earth due to its motion, pushes it away from the Sun and the gravitational attraction between the Earth and the Sun pulls the Earth toward the Sun, keeping the Sun-Earth system going. In the Vedic frame of reference there is no need for the Dark Energy for the solar system to function. The two *yuvatis* in the Vedic frame of reference are the forces of dynamics (*Vaayu-devata*) and gravitational attraction (*Aapah-devata* = matter with mass). Therefore the two *yuvatis* of the *Skambha sukta* of the AtharvaVeda and of the *Dhyaava-Prithvi sukta* of the RigVeda are respectively the *Vaayu-devata* owing to the rotation of the universe that stretches the cosmic web outward in all six directions and the *Aapah-devata* with the property of mass/gravitation that contracts it inward from all six directions.

## Aapah-Devata and Vaayu-Devata in Einstein's Field Equations

To determine whether the universe will contract or expand, two constants in Einstein's Field equations are crucial; the universal gravitational constant G representing the force of gravitational attraction due to mass in matter to contract and the cosmological constant $\Lambda$ (lambda), representing the repulsive force of Dark Energy. The red-shift in the spectrum of faraway galaxies indicates that $\Lambda$ is presently dominating over the effect of G. The value of the red-shift in galaxies indicates that the universe is expanding at an alarming rate.

With the consideration of the two *yuvatis* of the Veda, the *yuvati* (force) gathering the cosmos due to matter (*Aapah*) is equivalent to the gravitational force (G) which can be represented by A for *Aapah*. Both A and G have the same meaning and mechanism.

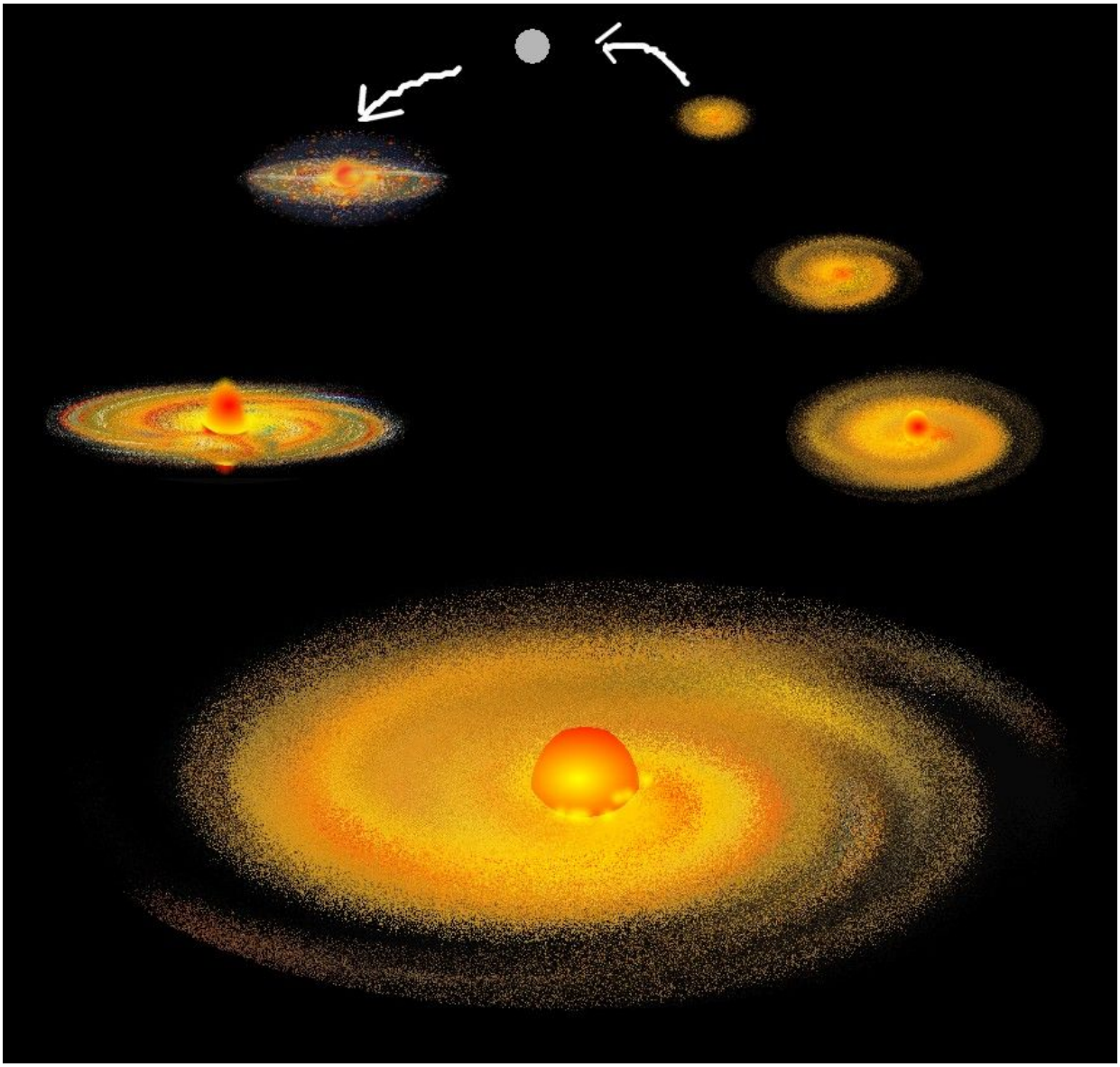

**Figure 9.8:** Two *yuvatis* (opposing forces) actively weave the web of the universe (AtharvaVeda, 10/7/42). The force of expansion V (*Vaayu*) dominates on the left arm of the diagram and the force of attraction A (*Aapah*) causing contraction of the universe dominates on the right arm of the diagram.

The *yuvati* expanding (spreading) the web of cosmos being the centrifugal force of rotation (*Vaayu*) of the universe, is equivalent to the Dark Energy ($\Lambda$) and can be represented by V. Both V and $\Lambda$ have different meanings and mechanisms as explained below. The dominance of V over A

is represented by the left arm of Figure 9.8 and the dominance of A (or G) over V is represented by the right arm.

The Vedic mechanism with the set (A, V) (inward Gravitation force, outward Centrifugal force) being equivalent to (G, $\Lambda$) respectively applies to our solar system and explains the equilibrium between the Sun-Earth system with the expansion and contraction at a minute level though, whereas the (G, $\Lambda$) in Einstein's Field equations may apply to the universe but logically do not apply to the solar system because the Dark Energy does not have a meaningful role in expanding the Sun-Earth system.

In the Vedic mechanism the 'invisible harness' of G the gravitational field keeps the Earth pulled towards the Sun and owing to the rotational kinetic energy of the Earth-Sun system the Earth is being prevented from falling into the Sun. No Dark Energy is needed to counter the force of gravity to maintain this dynamic equilibrium in the Sun-Earth system. In fact, as discovered by the Russian astronomers, Krasinski and Brumberg in 2004, the Earth is moving away from the Sun at a rate of about 15 cm per year. But the Dark Energy is not its cause. A few explanations for the Earth's recession from the Sun are found in literature; Dark Energy is not one of them.

One explanation relates to the **gravitational coupling** between the Sun and the Earth. According to the Japanese astronomers it is the tidal effect between the Earth and the Sun that is causing the push of the Earth away from the Sun. The same effect is also observed between the Earth-Moon system where the Moon is being pushed away from the Earth at a rate of 3.8 cm per year. The gravitational coupling between the Earth and the Moon, an invisible effect, creates the tidal bulge on the Earth, a visible effect. The tidal bulge on the Earth creates a torque on the Earth's rotation which drains the angular momentum and the rotational kinetic energy from the Earth's spin. To conserve the momentum between the two bodies, the loss of the angular momentum in the Earth is gained by the Moon, resulting in accelerating the Moon, raising it into a higher orbit. The gravitational coupling between the Sun-Earth system is expected to do the same.

Another explanation for the recession of the Earth from the Sun relates to the Sun losing its own mass. The Sun is continuously converting its Hydrogen into energy through fusion reaction which is continuously transmitted out reducing the Sun's mass. The Sun is also losing its mass through solar-flares and solar winds composed of particulate matter. The Sun

losing its mass means the weakening of its gravitational pull on the Earth, causing the Earth to slowly fly away from it. This is equivalent to the transfer of angular momentum from the Sun to the Earth through gravitational coupling, increasing the separation between the two. The loss of mass/energy by the Sun, which is the *skambha* of the solar system, is the gain of momentum by the Earth. The centrifugal force on the orbiting Moon pointing away from the Earth or the centrifugal force on the orbiting Earth pointing away from the Sun creates a perennial tendency on the orbiting object to increase the separation. Similarly the loss of energy and momentum by *Skambha* the pillar of energy at the centre of the "cart wheel of the Creator", the universe, is the gain of momentum for all rotating galaxies. The result is the expansion of the universe.

It is also the game of gain and loss of energy and momentum by the *Skambha* that leads to the *pralaya* (dissolution) of the universe. In light of this discussion the cosmological constant $\Lambda$ in Einstein's field equations representing the hypothetical Dark Energy of the modern Big Bang Hypothesis in reality is the centrifugal force (*Vaayu-devata*) due to the rotation of the universe. The Vedic concept of the rotating universe makes a high degree of sense.

Let us now complete the analysis of the AtharvaVeda mantra (10/7/42) of the two *yuvati*-forces presented above. An important term in the mantra is अभ्याक्रामं। (*abbhyaakraamam*) for transgression into each other. This is a brilliant term to define the act of one penetrating the other and vice-versa. The ordinary translation of the term is - '*while invading into each other's territory'*. One could not find a better term to explain how different forces in physics transgress each other.

An example in physics for *abbhyaakraamam* is a magnetic field around a magnet penetrating into the Earth's gravitational field and vice-versa. When a magnet picks up a piece of iron, the magnetic force pulls the piece up owing to the magnetic property in iron while the gravitational force of the Earth, owing to the property of mass in the same piece of iron, is pulling it down. The upward pull on the piece of iron by the magnet is the sum total of the pull on all individual atoms in the piece and the downward pull on the same piece due to the Earth's gravity, is the sum total of the gravitational pull on the mass of each atom of the piece. Thus the magnetic field and the gravitational field are transgressing each other while doing their own action

independently. This is the अभ्याक्रामं[1] (*abbhyaakraamam*) transgression of the two opposite *yuvati*-forces of the mantra.

Although the terminology in modern cosmology may not put it the way the mantra did, the G and V (Gravity, *Vaayu*) in Vedic expression are in अभ्याक्रामं[1] (*abbhyaakraamam*) of each other in all षण्मयूखम्[3] (*shan-mayukham = in the dynamic six directions*). In fact each force in nature has the property to do its own job while permeating other forces, without attacking them. Another example of this permeation is the electromagnetic and gravitational fields coexisting within each other without destroying each other. The Nature chose to have this mysterious coexistence in separation between the different forces because if one force destroyed the other the universe will not come into existence?

The true sense of the parable in the mantra is that the two opposing forces permeate each other without affecting each other but each is physically affecting the matter. How did the forces evolve acquiring such a property or how were they originally created that way, is beyond the grasp of a physicist. It is also remarkable to note that a complex concept in physics such as the permeation of forces has been dealt with in poetry of unparalleled beauty. The RigVeda chose to give the example of two fragrences permeating each other. In the next mantra below, the two *yuvatis* of the parable are said to be engaged in their independent **dance.**

Substances with form are perceptible like millions of objects on the Earth and the millions of celestial bodies in space. The formless entities such as the forces and energies are imperceptible but their effects are visualized when they interact with substances. However, the human limitation does not always permit complete understanding of all phenomena. This is expressed in yet another mantra with the parable of the two *yuvatis*:

तयोरहं परिनृत्यन्त्योरिव न वि जानामि यतरा परस्तात ।
पुमानेनद् वयत्युङ्गृणत्ति पुमानेनद् वि जभाराधि नाके ॥

(AtharvaVeda, 10/7/43).

**Word Transliteration and Translation:**

तयो: (*tayoh*) = among them (two *yuvatis*), अहम् (*aham*) = I / self, परिनृत्यन्त्यो: इव (*pari-nrityantyoh iva*) = busy as in a continued dance, न वि जानामि (*na vi jaanaami*) = I cannot comprehend or I continue to be ignorant

about it, यतरा (*yatara*) = which one, परस्तात (*parastaat*) = is far from the other।
पुमान् (*pumaan*) = All-pervading Purush the Creator, एनत् (*enat*) = this (web), वयति (*vayati*) = weaves, उत् गृणत्ति (*ut grinatti*) = swallows it, पुमान् (*pumaan*) = The Creator, एनत् (*enat*) = this, वि जभार (*vi jabhaar*) = had spread it, नाके अधि (*naake adhi*) = right within the Space-entity / supported on the Space-entity ॥

**Mantra Translation:**

> *"I am without cognizance in differentiating between the two yuvatis in a perpetual dance as to which one is farther away from the other. The Creator weaves this network* (of cosmos) *and swallows it* (at the end of creation). *The Creator spreads it and supports it on the Space-entity."* (AtharvaVeda, 10/7/43).

This mantra states that the ultimate real weaver who creates the strands for the network of cosmos is the all-pervading Brahmn (the Creator). He creates it in the creation phase (*srishti*) and ultimately swallows it back when the *pralaya* time comes. The usage of specific terms in the mantra creates a depiction of the state of the universe. The term वयति (*vayati*) for '*He weaves'* in conjunction with वि जभार (*vi jabhaar*) for '*had spread it*' are definitely for the network of cosmos that was discussed above. With the term नाके अधि (*naake adhi*) for '*supported on the Space-entity*', He is also given credit for placing the *srishti* within the Space-entity that must preexist the matter of the universe. With the term गृणत्ति उत् (*grinatti ut*) meaning '*He swallows it*', He is credited with the action of taking the network of cosmos back into Himself. This vivid picture of the network of the cosmos to appear in the creation phase (*srishti*) and to disappear in the dissolution phase (*pralaya*) is unique to the Vedas and expressed in very attractive, decorated poetry. One is reminded of the amazing action of a spider which creates a strand of high tensile strength to climb down and go up उत् गृणत्ति (*ut grinatti* = swallows) swallowing the entire strand that it created.

There was no indication in the earlier mantra (AtharvaVeda, 10/7/42) that the two females, the *yuvatis*, created the net themselves or that they will swallow it, rather the emphasis there was that they were engaged independently in their independent acts: *"... one yuvati* ***spreads***[4] ***the strands*** *of the web, the other* ***gathers***[5] *them together. They do not relinquish their action and rest, yet neither reaches the finale"*. The net pre-existed the two *yuvatis* for them to act on. The finale is credited to the Creator in the last mantra above (AtharvaVeda, 10/7/43) when He ends the cosmic drama by swallowing the entire universe.

The अहम् (*aham*) for 'I' in this mantra is a general term for anyone. Here it could be for the *rishi* who laid down the mantras of the *Skambha sukta*. The two *yuvatis* in a continual dynamic dance indicate that the processes of spreading and collecting the web of cosmos are not casual random acts because the act of dance is never without a rhythm and cycle. The rhythem and cycle in physics expression are the waves. Therefore if these two *yuvatis* are two forces of nature, their existence is associated with waves: the waves responsible for stretching the universe as well as for contracting it.

As mentioned before, a natural property of a two-dimensional or three-dimensional stretched-out net is that any disturbance at one point on the net is transmitted through waves to all other points of the net. Once the universe is defined to be a 3-dimensional network of cosmos it is a dynamic system in the cosmic dance. The act of the two *yuvatis* (forces) in a cosmic dance is a time-dependent phenomenon.

Since the modern Big Bang Hypothesis does not suggest the Dark Energy or the Gravitational Force of the universe having any time-dependent variations, the deduction out of this mantra certainly presents one more mystery about the created ensemble of cosmos called the *Prajapati*. The Vedas have expressed with clarity that the creation process is not just a 'letting lose' of matter and energy in the empty space. Rather implicit in the process is that the created matter takes shape; it is sustained in a dynamic state for a given period and then dissolved. The process includes a rhythmic cycle of expansion and contraction in the likeness of the breathing system in living organisms. That the universe could be riding on the wave of expansion and contraction with a given rhythm, during a given time epoch in its life is another mystery of the Vedic Big Bang. This possibility is yet to be discovered in the modern Big Bang Hypothesis.

The *rishi* of the mantra posits that the understanding of the process of the sustenance of the universe with the two opposing forces is complex and undecipherable. Of the two forces that are constantly in a dynamic state, dancing perpetually, the *rishi* of the mantra finds it difficult to determine which force, the force of expansion or the force of contraction, has the farthest reach in the infinitely spread out universe. The implication is that both are present at all places of the universe. The Vedas being theistic, the *rishi* in the second line of the mantra assigns the Creator energy field as the 'first-cause' of the creation.

The question arises - what is to be the fate of this brilliant colourful fabric knitted by the Divine Weaver? Does it keep going and end up in a Big Chill or will it collapse in a Big Crunch? The answer is provided in the same line where it states that the Creator swallows it back, hinting at the Big Crunch. This is consistent with the Vedic principle that the creation-dissolution of the universe is an eternally flowing long-term cyclic phenomenon.

It has been said a number of times that each syllable in a Sanskrit word has a meaning and the word itself caries complete meaning of what it stands for. Consequently when a simile is used in the Vedas it will be logical and meaningful without confusion. The term गृणत्ति (*granatti*) for swallowing is most appropriate to describe what happens to the universe when the *pralaya* (dissolution) comes. The term गृणत्ति (*grinatti*) for swallowing stands for an action that has a beginning and an end. The common observation is that in the action of गृणत्ति, a morsel is deliberately picked at a given moment of time, is put in the mouth – a planned action. Then it disappears. The disappearance of matter in the context of the creation is consistent with the definition of the *Asata*-state of matter in the dissolution phase of Nature, where the matter was there, non-distinct; but had not yet come into variegated observable existence. The other Vedic term for the *Asata*-state of Nature being '*avyakta'*, meaning "*indefinable in words*", the Nature is in the likeness of a morsel when it is put in the mouth and swallowed. The last line of the mantra reiterates with emphasis that the Creator is the one who puts this universe in Space. Implicit in the mantra is the submission that we do not understand fully the dynamic nature of the universe, but the all-pervading conscious-being Creator does.

The above exposition of the Vedic thought leads this author to summarize the main outcome in a postulate that with proper mathematical

investigation could lead to new possibilities in the study of cosmology. Let us call this postulate – "The Oscillating Universe Postulate".

> *"The universe during the creation phase is embedded in two opposing oscillatory energy fields of different natures with time-periods of cosmological scales, one energy field being the gravity and the other being the inherent angular momentum"*. (Shiv Raj Pal)

Just as the Sun has the 11 year cycle of sunspots causing the solar radiation to go through a cycle of maximum-minimum, the universe could also have a long-term inherent oscillatory character. The possibility of such a postulate exists in a rotating universe with a central *Skambha* as the basic source of energy for the engine of the universe.

Our solar system, with planets and the rotating Sun at the centre serving as the *skambha* of energy, is in a dynamic equilibrium. Our galaxy, the Milky Way Galaxy with billions of stars in it, with a rotating central bar as its *skambha*, is also in a dynamic equilibrium. The mysterious Dark Energy of modern Big Bang Hypothesis may be causing the expansion of the universe; its effect is indiscernible at smaller astronomical scales. It is not pushing the planets apart in the solar system and is not known for pushing the stars apart in a galaxy. The Vedic mechanism with the gravitation pulling in the matter of the universe and the centrifugal force of the rotating universe expanding it are real and govern the entire universe. In Vedic thinking therefore these two real forces that are well known in physics today, play the main role in sustaining the universe. A postulate such as the one framed above should apply to the universe with dynamic symmetry all through it; at the level of the solar system and at the level of the galactic system.

# Expansion of the Universe: Big Bang Hypothesis versus Vedic Big Bang Scenario

We gather from some deductions in modern cosmology that the expansion of the universe was slowing down up to about 10 BY and it began to accelerate for the rest of the last 3.8 BY. From the perspective of the modern Big Bang cosmology there are two possible causes for the slowing down of the expansion of the universe – increase in gravitation of the universe pulling matter back or the weakening of Dark Energy slowing the expansion. Since the mass of the universe from its beginning is assumed to be constant, rendering the same gravitation, it must be the Dark Energy that becomes weaker to slow the expansion.

Presently the universe is said to be expanding exponentially the Dark Energy must have increased exponentially. What would have caused that? The modern Big Bang hypothesizes further that more Space created by expansion creates more Dark Energy. The validity of this argument hinges on the source of Dark Energy - whether it is created "out of nothing" or it is created out of the ingredients present in the Space. If the Dark Energy is created "out of nothing", who can avouch that the early concentrated Space did not create high density Dark Energy and vice-versa? The hypothesis that more Space creates more Dark Energy remains a conjecture if it is not explained what is the structure of the Space and how the Space quantum is used up to create a quantum of Dark Energy.

The Vedic Scenario on the other hand is straight forward with the gravity in the mass of the universe pulling the universe inward and the rotation of the universe throwing cosmos outward. Therefore in the Vedic Scenario an explanation for the slowing down of the expansion of the universe is also straightforward. If the *Skhambha* of the universe loses energy (and mass), which it does with time, and slows down as a result, the centrifugal force on the universe is also reduced slowing down the expansion of the universe.

The deduction from modern cosmology that the expansion of the universe first slowed down and then increased exponentially however hints that there could be some wave activity in the two opposite energies (two

opposing *yuvatis*) responsible for the expansion and contraction of the universe. This suggests that the force that causes expansion is variable over cosmological time-scales to supersede the force of gravity causing the slowdown in expansion until 10 BY. This 'dance of the two forces', - "*one yuvati spreads*[4] *the strands of the web, the other gathers*[5] *them together…*", requires new investigation in the Big Bang Hypothesis. In addition to the Vedic references presented above that reveal the cause for expansion and contraction of the universe on a periodic basis a few more related references are presented below.

## *Vaayu* the *Devata* of Expansion

Earlier it was stated that the property of the *Agni-devata* (heat-energy) is to expand the substances and that one *devata* is convertible into another. Conversion of *Agni-devata* (heat energy) into the *Vaayu-devata* of motion is a natural process. From a number of mantras and part mantras on this topic a few have been chosen here.

**(1)** The tri-property *Aapah-devata* at its most fundamental state is in energy form. Its degeneration under certain proportions of the three properties of *sata, raja* and *tama* creates matter with the property of mass leading to the property of gravitation which enables the formation of colossal celestial bodies. The other four all-pervading *devatas*: *Vaayu* (property of dynamics), *Agni* (heat energy), *Indra* (property of electricity) and *Som* (chemical energy concealed as the molecular bond-energy) are all in the energy form. Among the many virtues of the *Agni-devata* which is the energy (not fire), the Vedas assign *Agni* for spreading all substances. A YajurVeda mantra (12/48) with a similar emphasis states that-

"*…agni (energy) spreads the Antariksh* (Space) *to its greatness"*. (YajurVeda, 12/48).

The Shatpath Brahmana (7/1/1/23) provides an interpretation of this YajurVeda mantra stating that the *Agni-devata* pervading through the *Antariksh* is seen in the form of *Vaayu*-energy; implicit here is the kinetic energy in the cosmos. Therefore, in Vedic thinking it is the heat energy that initiates the expansion of the universe accompanied with the force of kinetic

energy (*Vaayu*) that keeps the universe in expansion mode against the gravitational force of the *Aapah-devata*.

**(2)** Etareya Brahmana (10/9/5) states:

"….*वायुना*[1] *हीदं यतमन्तरिक्षं*[2] *न समृच्छति*[3], …."।

"….*Vaayunaa*[1] *heedam yatmantariksham*[2] *na samrichchhati*[3] "

**Translation**

> *"Owing to the force of Vaayu*[1]*, the Space*[2] *with cosmos in it does not go into the pralaya*[3] *phase (dissolution)"*. (Etareya Brahmana, 10/9/5)

This ancient statement in the Etareya Brahmana commentary on the RigVeda mantra (6/16/10) is yet another fundamental lesson in physics. The recognition of the invisible Space (*Antariksham*[2]) as a real entity, by itself is a physics thought at a high intellectual level. That there is a real invisible Space-entity penetrating through all substances in the universe is a repeated theme of the Vedic Cosmology. It is the Space-entity (discussed in Chapter 5) that has not been understood fully by the modern physicists.

The last term in the above statement, *richchhi*[3], means *pralaya* (dissolution) of the universe. The emphasis in the statement is that it is the dynamics (*Vaayu*) that keeps the universe from collapsing. The first part of the statement (not included here) also says that the *Vaayu* is the *niyanta* (controller) of all cosmos. According to his statement it is the *Vaayu-devata* that does not let the Space go into *pralaya*, meaning - the *Vaayu-devata* with its rotational energy pushes the cosmos in the outwardly direction.

**(3)** A phrase in a YajurVeda mantra (1/16) characterizes *Vaayu*, the *devata* of dynamics in the universe, as *वायुर्वो विविनक्तु* (*vaayurvo vivinaktu*). This mantra is also taken up for commentary by Shatpath Brahmana (1/1/4/22) the ancient Brahmana book on YajurVeda. The phrase translates into – "*Vaayu with the property of separating the objects*". This phrase is indicative of the rotational motion of the universe and all celestial bodies that creates a tendency of centrifugal force. In this mantra the conterminous nature of *Vaayu* is also praised.

**(4)** A statement in Kaathak Samhita (13/12) expresses the same thought,

"*The cosmos were close together. The Vaayu separated them.*"

It could be deducted from the Vedic perspective that the *yuvati* that stretches the web of the universe is the *Vaayu-devata* with its origin in the *Agni-devata* the heat-energy. A contemporary astronomer has said about the cosmological constant lambda, $\Lambda$, that - "*since we don't understand where the cosmological constant comes from in the first place, there's no especially good reason to suppose it won't change drastically at some point. We just don't know*". The author of this book with all humility ventures to suggest that in modern cosmology some fresh thinking on new possibilities is overdue. This fresh thinking must be based on what is obvious, understandable and available in the creation rather than putting all weight on hypothetical energies and forces. God is a non-provable hypothesis but what excuse does a physicist have for putting forward hypotheses that are not provable? The *Vaayu-devata* of the Vedas represented by V here is more appropriate in Einstein's field equation than the cosmological constant lambda, $\Lambda$.

## The Beauty of *Aapah-Devata*

It was stated in Chapter 5 that the term *aapah* in the Vedas inherently represents plurality and is also addressed in the female-gender. In the Vedas and the Vedic literature a beautiful virtue associated with *aapah* is *sneha*. The meaning of the term *sneha* is '*that which brings things together'* and also '*that which enables bonding*'. The *Aapah-devata* serves as the seed for matter creation in the universe bringing fundamental particles together, ultimately forming atoms and molecules to form the cosmos.

Based on the Vedic thought, this author's perspective on *aapah* is that at the commencement of the universe it transits from its most fundamental triplet particle state of *sata, raja* and *tama* into bigger matter particles forming the atoms of matter. The smallest atom of modern physics is Hydrogen. Since the fundamental *aapah* are at the core in forming Hydrogen, the Hydrogen in the Vedic context would also be *aapah*. Likewise the formation of bigger atoms out of multiple *aapah* is said to be secondary and a coarse state of *aapah* such as the bigger atoms of Oxygen, Nitrogen, Silver, and Gold etc. This is why the author termed these coarser states as the degenerate state of the fundamental *aapah*. Therefore, in Vedic

vocabulary an atom of Oxygen is also *aapah*. When Hydrogen and Oxygen come together, that higher (degenerate) state of *aapah* forms the water molecule ($H_2O$). Water being in the hierarchy of *aapah*, the life-sustaining nectar called water continues to be addressed as *aapah* in the Vedas and the Vedic Literature.

It is observed that the continued property of *sneha* in water plays the most important role in the bonding of the molecules in both, inanimate and animate realms. An example of this bonding in the inanimate realm is the water molecules bringing together the brick molecules and the example of bonding in the animate realm is the living cells coming together in the body of a living-being. The additional property of mass in *aapah* creating mass-mass attraction, gives rise to the force of gravitation that helps to create the entire universe.

# Shape of the Universe in Vedic Literature

Several Vedic references have depicted the shape of the universe with differing perspectives: representing the top view, side view or just a qualitative description. They are briefly discussed in the following.

## (1) Vedic Universe a Flat Sheet

As discussed under the sub-heading "Flatness Problem" in Chapter 2, modern cosmology states that 'the universe is flat'. This flatness however has an altogether a different meaning than the common understanding of a flat object with negligible thickness compared to its length and width like a sheet of paper. A flat sheet of paper is seen flat because we are outside the paper and see its dimensions. The flatness in modern cosmology relates to how the geometry works inside the universe. When a large triangle is drawn in the universe with its arms covering large astronomical scales, the triangle's arms do not curve and the sum of the three angles of the triangle add up to 180°, same as when a triangle is drawn on a flat table-top. This is equivalent to saying that the space-time and the mass-energy of the universe

do not warp (curve) the sides of the triangle. This also means that the Euclidean Geometry applies to the universe and the cosmologists say that the universe is flat, even though its outside shape may be a spheroid like the Sun or ellipsoidal like a galaxy. Based on new and accurate observations the astronomers have concluded that the universe is completely flat without any curvature.

The fact is that we are able to look into the universe all around us (with powerful telescopes) in a sphere of diameter about $8.8 \times 10^{23}$ km with galaxies strewn uniformly all around us up and down, sideways, near and far. The fact is that there is more universe beyond the observable universe.

It was discussed earlier in this chapter under the sub-heading, "**Sustained Dynamic Equilibrium of the Vedic Universe: A Tug-of-War between Two Opposing Real Forces",** that the universe in the Vedic Cosmology is in the semblance of a rotating enormous "cart-wheel" embedded in the invisible field of fundamental *Aapah* matter. Under this premise the meaning of the "flat universe" means the shape of the universe as seen from outside this cart-wheel.

Vedic cosmology eons ago also said in different contexts that the universe was flat and described it with intriguing similes of its own. This flatness implied that the universe when viewed from outside the universe was not spherical as expected in an explosion. It said that the universe was flat like a "*woven sheet of cloth*" and that the Creator "*spread the universe like a skin*" as a leather-artisan stretches and spreads the skin. The flattening of the universe in the Vedic Cosmology is a result of the natural process of the rotation of the universe. This is discussed further under the heading of, "Consequences of Rotation of the Universe around an Axis".

Considering that the universe is a flattened entity and we are only able to observe up to the periphery of the observable universe within it and not beyond it, because the light from there has not reached us yet, the universe has to be far more expansive laterally than presently thought. According to the red-shift observation of distant galaxies, the vastness of the universe is continuously increasing because it is expanding exponentially fast. The Vedic hyperbole of such a situation is "*ananta*", which means that the end of the universe is unreachable but it does not mean that the universe has no end. In the logic of Vedic Philosophy an entity that has a beginning at a given point in time and space, cannot become infinite. The Vedic universe begins at a given point in time with *tuchchhaya* (diminutive) volume of the *Asata-*

state of matter. Therefore the universe at present may be infinitely large but is not infinity.

Surprisingly the references in the Vedas and the Vedic Literature on the universe being a flat sheet are plentiful. In addition to several references already presented, the RigVeda mantra (8/6/5) states –

> "…*the Creator's brilliant energy spreads the Rodasi* (space holding the solar system) *uniformly like a skin is spread…*"

In the two RigVeda mantras presented in Chapter 6,

> "… *the universe in its vastness* (**आयतः** = *aayatah*) *is weaved like a cloth…*" (RigVeda, 10/130/1) and,
>
> *"…The Creator-himself stretches* (**तत्ने** = *tatne = expands*) *this universe within the vast Space* (**नाके अधि** = *naake adhi*)…" (RigVeda, 10/130/2).

Therefore, the Vedic description of the universe, *like a skin*, *like a cloth*, stretched in space and so on presents the universe as a flat sheet. These eons old Vedic deductions having common terminology with the contemporary cosmology is amazing.

Considering that in Nature there is symmetry and hierarchy in the symmetry, the Veda stipulated universe, composed of galaxies, is in similitude of a galaxy itself. In a reference in the Vedic Literature, a simile is drawn between a *yava*-seed and the Space-entity holding the universe.

## (2) *Yava*-shaped Universe

The definition and detailed discussion on *Antariksh* the Space-entity in Chapter 5 revealed numerous unique properties of the Space-entity, not recognized in modern cosmology hitherto. In addition to a large number of synonyms for the *Antariksh*, each representing a property, the author has come across in the Vedas several adjectives attached to it such as the *atoort Antariksh* (conterminous Space-entity) and the container of the universe. Therefore, it could be assumed that the shape of the Space-entity is more or less the same as the shape of the universe itself.

According to a statement in Taittireeya Samhita (2/4/11) the *Antariksh* is in the shape of a *yava* grain (see also Bhagvaddata, p.185),

"*…the form of Antariksh is like a yava grain with a bulge in its middle*." (Taittireeya Samhita, 2/4/11).

This statement of Taittireeya Samhita is particularly for the physical shape of the *Antariksh* (Space). It is important to note that the *Antariksh* (Space) and *Vishva* (universe) in the Vedic terminology are two different entities; the latter immersed in the first. Both could be of the same size and shape or there is a possibility that the universe is much smaller than the vast stretched out Space. Since the Vedic universe is said to be a rotating wheel-like system with a *Skambha* pillar of energy at its centre, the shape of the universe could be the same as that of the Space with a bulge in the centre as in a *yava* grain. Even if the *rishi* compares the universe to a galaxy, it is remarkable that he should specify an elongated shape to the universe with a central bulge and not be intuitive and say that it is a sphere. What is the shape of a *yava* grain?

In addition to *godhoom* (wheat), *akshata* (rice) and other popular grains cultivated and consumed by the Aryans of Aryavart (India), the *yava* grain has been thought to be of high medicinal value and has been a part of their staple diet as well. The *yava* grain continues to be an auspicious item in modern Hindu worship and celebrations. *Yava* is in the family of barley with thin husk on. A *yava* grain is an elongated ellipsoid with a bulge in the middle with both ends converging into narrow pointed ends. This should represent the side view of the *Antariksh* or of the universe embedded in it, something similar to the side view of a galaxy. The proportion of length to thickness of a *yava* grain is somewhere around 15 millimeters to 3 millimeters (Figure 9.9). Therefore, the thickness of the universe according to this reference is much smaller than its spread out width.

The basic point in this shape comparison between the universe and the *yava* grain is that the universe is lenticular (lens-like) when viewed edgewise like viewing a *yava* grain from the side. The actual pictures of *yava* grains on the left-side and the shapes of typical galaxies on the right-side are shown in Figure 9.9.

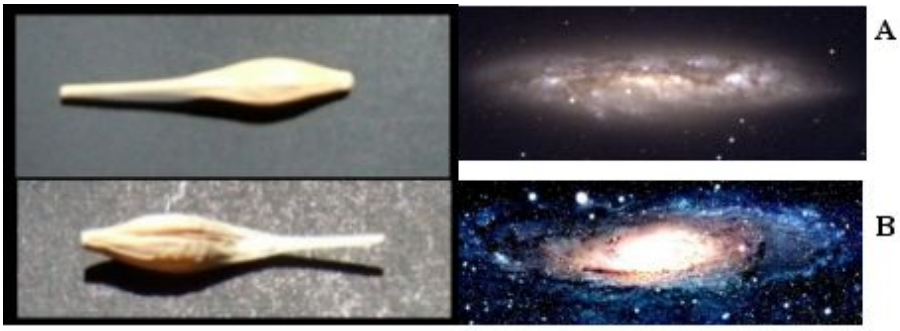


Figure 9.9: Left hand side: *Yava* grains (actual size 15 mm by 3 mm). (**A**): The Andromeda Galaxy, M31 (NASA/JPL-Caltech). (**B**): Messier Galaxy 108-NGC 3556 in Ursa Major constellation (NOAO/AURA/NSF).

As discussed earlier, the symmetry in Nature in the Vedic perspective extends from the universe down to a solar system. Consequently, the rotating universe is expected to be in a shape similar to a typical galaxy.

## (3) The Universe like a Tree

The following AtharvaVeda mantra provides yet another simile for the shape of the Vedic universe.

महद् यक्षं[1] भुवनस्य[2] मध्ये[3] तपसि क्रान्तं सलिलस्य[4] पृष्ठे[5] ।
तस्मिन् छ्रयन्ते य उ के च देवा वृक्षस्य[6] स्कन्धः[7] परित[8] इव[9] शाखाः[10] ॥

(AtharvaVeda, 10/7/38).

**Transliteration**:

"*Mahad yaksham[1] bhuvanasya[2] maddhye[3] tapasi kraantam salilasya[4] prishthe[5]* ।

*Tasmin chhrayante ya oo ke cha devaa vrikshasya[6] skandhah[7] parita[8] iva[9] shaakhaah[10]* ॥"

**Mantra Translation**:

*"The great Unitary Spirit the Brahmn[1] with His power and governance resides in the midst[3] of the universe[2] which is sustained on the back[5] of the salilam[4]. The entire creation, with the devas and the brilliant objects like[9] the branches[10] around[8] the trunk[7] of a tree[6], resides within the Brahman"*.

(AtharvaVeda, 10/7/38).

All brilliant cosmos and the *deva* energy fields are different limbs of the universe that reside on the back of *salilam*[4], the invisible ubiquitous *aapah* field and all reside within the Unitary Spirit called the Brahmn[1]. The Creator in the Vedas, a formless entity, governs the universe centrally and by pervading through it. This mantra draws a simile of the universe to a tree (वृक्ष[6] = *vriksh*) with a trunk (स्कन्ध:[7]= *skandh*) in its centre and branches (शाखा:[10] = *shaakhah*) around the trunk representing the entire universe (भुवन[2] = *bhuvan*). All branches and leaves of a tree are connected with each other and need the trunk to support them. The trunk is needed for the energy flow to sustain all branches and leaves of the tree. This simile of a tree for the universe once again points to the *Skambha* of the universe, the physical structure in the centre of the universe, the source of energy. The presence of the All-pervading *Brahmn* (Creator) supplies His *tapasi kraantam* (brilliant energy) to keep the universe energized.

In several other Vedic references a simile is drawn between the Nature-entity and a tree. In Chapter 5 under the sub-heading of "Vedic Trishtup (Vedic Trinity)", a few references in a different context were presented (RigVeda, 1/164/20; AtharvaVeda, 9/9/20; Mundak Upanishad, 3/1/1) where the Nature-entity is depicted as a tree and it is being watched by the Creator from "all around" and the fruit of the tree is consumed by the living-beings. In other references presented in Chapter 5 under "The Nature-entity (*Prakriti-tatva*)" the universe is addressed with an adjective of *vriksha* (tree). It is mysterious yet remarkable on the part of the Vedic *rishis* that the shape of a vast and ungraspable entity, the universe, was visualized as a tree. The Veda has used the synonym *uttaan-paad* for *vriksh* the tree, where the word-meaning of the adjective *uttaan-paad* is '*one whose feet are pointing upwards*', the feet of a tree being its roots. Most living beings with well-defined feet have their feet pointing vertically down. Contrasting with this

the roots of a tree spread horizontally first and then begin to curl upwards, hence the Sanskrit naming of *uttaan-paad* for a tree. The term *uttaan-paad* for the creation (Nature) has appeared in several places in the Vedic Literature. This creates a visual for the shape of the universe, yet remains mysterious.

Yogiraj Lord Krishna, a follower of the Vedas and having deep knowledge of the Vedic science of creation, has addressed the universe in the Bhagvadgita (15/1-2) as an ऊर्ध्वमूलम् अधःशाखम् (*urdhva-moolam adhah-shaakham*). The two expressions together mean – '*like a tree with roots pointing upward and the branches pointing downward*. These references imply that the universe is distributed around a central axis (trunk). This axis is the *Skambha*, the pillar-of energy supporting the universe around which the branches and leaves are like the cosmos, all interconnected in a *vetsam* (network).

The consequences of a rotating universe are immense. Some have been mentioned earlier and some more are in what follows. Important among these is the case of the red-shift, the sole indicator of the expansion of the universe in modern cosmology.

## Consequences of the Rotation of the Universe around an Axis

Under the matter-manifestation theorem formulated earlier, all *"Matter in the creation phase of the universe manifests with the inherent property of motion (Vaayu-devata) which is revealed through rotation and revolution at all its levels*. The hierarchy of this revolution-within-revolution is seen operational at all levels of the universe from inside an infinitesimal atom to a gigantic galaxy wherein the stars of the galaxy revolve around the galactic centre. What happens to the hierarchy of rotation/revolution beyond the level of a galaxy is not clear in modern cosmology. No conclusive observational

proof is yet available on what exactly the galaxies are individually engaged in with regard to their own motion in space.

There is however new thinking among some astronomers, cited in the science literature that some groups of galaxies might be together rotating around a common axis just like the individual stars in a galaxy. Further research would possibly reveal someday that the said group of galaxies is rotating around the universe's axis of rotation, common to all galaxies – the *Skambha* of the Vedas. However, the studies in modern cosmology/astronomy have not yet suggested that the whole universe is a one-wheel system of galaxies rotating around a hub, which so far has been the unique Vedic theme.

There may not be physics or mathematical possibilities to permit a cosmologist to hypothesize and prove that the entire universe is a rotating system. The possibility is that a thought similar to the one in the Veda mantras has not occurred yet in the modern cosmology. If it is surmised by the modern cosmologists that the Vedic scenario is not even a remote possibility, a natural question arises – why would the symmetry in rotation-around-rotation not go beyond a galaxy or beyond the cited cluster of galaxies that are thought to be rotating around some axis?

The consequences of the efficacious Vedic thought, that the universe is a rotating system with all galaxies going around its centre, are immense. The foremost consequence of this Vedic thought is that the cosmologists may have to rethink the Big Bang Hypothesis from entirely a different perspective. Additionally, there are several hypothetical possibilities that this author could think of that could lead to discovering new ideas in cosmology. Or these hypothetical possibilities could lead to ideas that may not be accordant with the present established framework of cosmology.

The measurement of speed of an object is always relative to something else considered stationary. Over one daily spin of the Earth (24 hours) a person stationary on the North Pole has zero linear speed, however, at the same time another person stationary at the equator is moving with a speed of about half a km/second around the axis of the Earth. With respect to the Sun a person on the Earth orbits around the Sun at a linear speed of about 30 km/second (Earth's linear speed around the Sun). The linear speed of the Sun (solar system) with respect to the galactic centre is about 217 km/second. Astronomers have stated that much larger speeds of much larger systems made up of multiple galaxies do persist. Therefore, a rotating

universe with all galaxies rotating at high speed around the Vedic *Skambha* remains a possibility.

Astronomers have observed that with respect to the average velocity of a large number of other observed galaxies, our Milky Way Galaxy with its 400 billion stars is traveling in a given direction at an extremely high speed. Observations revealed that the Milky Way galaxy along with the 50 other galaxies of the so-called Local Group is moving at a linear speed of over 552 km/sec in the direction of the Virgo Cluster.

Based on the microwave measurements on board a U-2 plane George Smoot and Keay Davidson in the book "Wrinkles in Time" (1994) state that "our galaxy is moving with a peculiar velocity of 600 km/sec, under the gravitational attraction of some distant, massive concentration of galaxies". Other estimates suggest that the Milky Way as a whole is moving with the linear speed of 630 km/second. It is also suggested that the Virgo Cluster itself is moving towards the Great Attractor in Hydra and Centaurus with a speed of over 6,000 km/sec towards the Shapley Super-cluster of other galaxies beyond the Great Attractor. Some have even thought that the Milky Way may be on a collision course with another galaxy.

However, as the *rishi* in the RigVeda mantra (1/185/1) queried rhetorically about the advent of the universe, '*…who is cognizant with detailed clarity O scholarly…*' , this author queries – is the Milky Way headed for a collision with another galaxy or is it just on its orbit around the centre of the universe? An immediate consequence of the Vedic principle that the entire universe is in rotation is that all these motions of galaxies and the group of galaxies mentioned above is explicable within the reference frame of the *Skambha*.

It may be difficult for astronomers to answer whether the motion of the Milky Way is strictly on a linear path in a fixed direction towards the Great Attractor or on a curvilinear path. If it is curvilinear, it could be on its way to completing another orbit around the centre of the universe just like the Earth around the Sun and the Sun around the galactic centre. If the Milky Way's path turns out to be curvilinear with the curvature detectable, the centre of the universe would be at hand. If not, then it could be on its way around another secondary *skambha* of millions and billions of other galaxies. The problem however may remain in ascertaining the curvature of the path of a galaxy around the *Skambha* of the universe, because the galaxy may be on

such a long curvature that even accurate measurements may yield only a linear path.

Our galaxy may be a part of the Vedic *paryaplav* rotation of the entire universe around the *Skambha* that continues after the Vedic Big Bang. The other way of indicating the same action of the galaxy is what was described earlier in this chapter as well as in Chapter 2, using the Vedic terms in mechanics that the galaxy is in *chakram-pari* (orbital motion). Or that the galaxy is in समानं (*samaanam*) अविवृत्सन् (*avi-vritsan*) around a धूर (*dhoor*) which together means – '***in a stable***, ***repeating orbital motion around an axis'***. If an astronomer finds that the path of a galaxy is linear with minimal or no curvature in it, it could be revealing that the centre of the universe is at an infinitely large distance from the galaxy.

A few more intriguing possibilities arise out of a rotating universe as in the following.

## (1). Dark Halo Surrounding the Galaxies

In the preparation to give birth to the cosmos the *Aditi* (Nature) prepares the Space-entity by filling it with the invisible field of *Aapah-devata;* minute to the point of being immeasurable with the tools in physics. Therefore, what is said to be the vacuum of empty space between the galaxies and stars is not empty rather it is filled with the most fundamental *Aapah* particles. The question is which of the three *Aapah* pervade through space: *satah*, *rajah* or *tamah*?

In the creation phase of matter the separation of the three components of the tri-property *Aapah* (*satah, rajah, tamah*) enabled the formation of the universe in three different overlapping realms: consciousness-realm, physical realm and the inactive background realm. The *satah-aapah* is dominant in the first two creations of *Aditi* (Nature), the fields of *Buddhi* (Intellect-element) and *Ahankaar* (Ego-element) utilized by the living bodies of conscious-beings. The *rajah aapah* is dominant in creating effulgent islands of matter and energy (celestial objects) and the inactive *tamah aapah* dominantly pervades in the empty space of the universe acting as the viscosity of space.

As discussed in Chapter 5 the *tamah*, known to be *krishna* (dark) and least participant in forming matter, serves with the remaining *satah* and

*rajah*, as the background in the void of the vacuum of Space and in forming the substantive body of a living being. All substances moving in space including a so-called mass-less photon of light, must endure the viscosity of the all-pervading background *tamah* component of the *Aapah-devata*. This author addressed a photon as the "so-called mass-less photon" because according to the Vedic definition of matter no matter particle is mass-less. It is this viscosity created by the invisible *Aapah*-field in the so-called vacuum of Space that sets the velocity of light to be $3x10^8$ meters/sec. There is no such thing as vacuum of space. The Vedic definitions of Space and matter clearly differentiate the two entities, each according to its own *dharma* (the specific rules and principles that govern the entity). The property of viscosity is offered by the presence of the all-pervading *Aapah-devata* whereas the Space-entity (*Antariksh*) serves only as a container of the matter of the universe. This leads to a new deduction:

> *"Space in space-time continuum with the added property of viscosity owing to the all-pervading aapah in it should lead to new insight in modern cosmology"*. (Shiv Raj Pal, 2015)

A common phrase in Quantum Physics is – "matter-antimatter particles appear out of nothing". This in Vedic perspective is not valid because all particles appear out of 'something' and that 'something' is the background field of all-pervading *Aapah-devata*.

When one grasps the concept of the preexistence of subtle energy/matter fields of the *devatas* throughout the Space of the universe, as discussed above, any mass placed in space, anywhere in the universe, is not in isolation; rather its presence is at the cost of the displaced ubiquitous preexisting background *aapah*. Since all substances in the universe are made up of *aapah* at their fundamental level, an exercise of putting a dense mass in the preexisting *aapah*-field is equivalent to denser conglomerate of *aapah* displacing the rarified subtle form of the background *aapah*. This is in the similitude of an ice-cube floating in water. The water molecules in the solid ice cube displace the water molecules in fluid form. What happens between an ice cube and the rest of the surrounding liquid water is a physical interaction between the two; even though both comprise water molecules. Such a physical interaction between the observable substantive matter embedded in ubiquitous invisible *tamah aapah*-field, should generate a new

perspective on the behaviour of the substantive matter bound to the galaxies and spread out in the inter-stellar space.

As discussed earlier, the *Aditi*'s (Nature) first action was to create seven progeny deva-fields filling all Space before hurling its 8th progeny (Mortal-ovate) far and wide. If the *Aditi* did not first fill the vacuum of Space with the *Aapah*-field the Space would not have the property of viscosity and all *hiranyaands* (golden ovates) hurled out by *Aditi* would shoot out with infinite speeds not to ever stop, leading to the "Big Chill". All celestial objects of the universe are naturally embedded in the field of inactive dark-*aapah*; probably the Dark Matter of modern cosmology.

The *aapah* around a *maartaand* (primordial celestial object), having the property of gravitation as well, are also expected to remain attracted to the *maartaand* thus creating a denser shell of *aapah* around and near it. When the galaxy is formed and flattened owing to its inherited rotational momentum, within the overall rotation of the universe, the displaced *aapah* surrounding the galaxy would be seen as the 'dark halo' around the galaxy that the astronomers describe differently as - 'the non-baryonic Dark Matter', the matter not made of regular atoms and molecules and does not emit light. The Dark Matter is also known as 'the missing mass of the universe'.

The astronomers suggest that the black halo at the periphery of a galaxy is due to the concentration of the Dark Matter. This raises several questions: (a) what is the source of the Dark Matter? (b) how did the Dark Matter reach there ? and (c) what turns the spread-out Dark Matter into the halo at the periphery of the galaxy? Whatever the answers may be from the modern Big Bang perspective, the answers from this author's Vedic perspective respectively are: (a) the Dark Matter of modern cosmology is the inactive Dark (*tamah*) *Aapah* of the Vedic creation; (b) it is part of the tri-property fundamental matter as the first creation of Nature, filling all space. It was there in the space before the galaxy formation began, (c) the rotation of a galaxy over millions of years sweeps the interspersed *Aapah* to the galaxy's periphery forming a dark halo.

Thus, the ubiquitous *Aapah* is the missing Dark Matter of modern cosmology. The Veda addresses it as *tamah* or *krishn*, which means dark. The dispersed *Aapah* by definition being the most fundamental stage of matter has no atomic structure in it to create electron transitions resulting in light emission. Hence the *Aapah* are the Dark Matter of the universe. The

displacement of the *aapah*-field by the gravitating celestial bodies and the sweeping action going with it could have created other phenomena as well. The bending of light rays and retardation in the speed of light could be such effects; discussed below. The important effect this author attributes to the background *aapah*-field is the property of viscosity in space discussed above which moderates the speed of moving substances, including the speed of light.

## (2). Dark Matter Mystery

The physicists accept that the Dark Matter exists and plays an important role exerting its gravitational force on the matter of the universe. They are hard at work to understand what Dark Matter is, how was it created, when was it created or was it always there as the 1/3$^{rd}$ of the "material-cause" of the universe called the *tama-aapah*? As discussed in Chapter 5 of Volume 1 that the most fundamental particles in the Vedic physics are a trio of *sata, raja* and *tama*; the *tama* being the most inactive.

With regard to the present understanding of the Dark Matter, Prof. Dan Hooper of Fermilab, Chicago University, summarized in an article in the "New Scientist", Vol 244, No. 3256, 16 November 2019 as:

"*….But the stubborn illusiveness of dark matter has left many physicists and cosmologists surprised and confused. In droves, we are returning to our chalkboards, revisiting and revising our assumptions – and with bruised egos and a bit more humility, desperately attempting to find new ways to make sense of a very dark and hidden universe.*"

The Vedic ideas may provide some possibilities!

## (3). Furrows in the Aapah Field- The Mirage of the Cosmos

This section is based on an unusual imagination of the author. Still, this imagination is not as wild as the imaginary Cosmic Inflation of the Big Bang Hypothesis that is said to last an unimaginably small time from $10^{-36}$ to $10^{-32}$

seconds after the onset of the Big Bang, yet ends up performing several unusual important miracles for the newly born universe! The author explores a few possibilities in the following.

The *cosmic dance* of *Aditi* continues on the stage of the *Aapah-deva* field. The galaxies of the universe, rotating in their curvilinear tracks around the *Skambha*, the rotational axis of the universe, sweep the background *Aapah*-field creating furrows in it. An immediate effect of this would be the decrease in the background *aapah* density in the curvilinear path behind the arms of the universe formed by the galaxies. The effect of the rotation of the universe and the sweeping by the matter arms is the increased density of the displaced *aapah* in the walls of the furrows.

A close simile to this is the water displacement by a speed-boat rushing on a curvilinear path. Just as a furrow created in water by the speed-boat recovers with time, a furrow created by a spiral arm of the universe made up of galaxies should change with time to readjust the distribution of the background *aapah* field. Due to the large scales in the size of the furrows, the time for the recovery of a furrow created by a spiral arm of the universe, could be in thousands and millions of years. The same argument applies to single galaxy with arms, where the drag of each arm of the rotating galaxy should leave behind furrows in the *aapah*-field.

As suggested earlier, the viscosity of the medium due to background *aapah* affects the speed of the photons (light). A furrow in the background *aapah* would create differential light speed in the furrow and its walls directing the light in a curvilinear path. The direct light along a straight line may not even reach the observer. This mechanism is depicted in the top view of the universe in Figure 9.10 where a galaxy is denoted by G and the observer on the Earth is denoted by E. The path followed by the light rays from the galaxy G is along the curved path GAE rather than along the direct path GE. An appropriate simile for this is the light transmission confined in a curved optical fiber bundle. The reduction in the intensity of light from a faraway galaxy could primarily be owing to the absorption of light in the denser walls of the furrows.

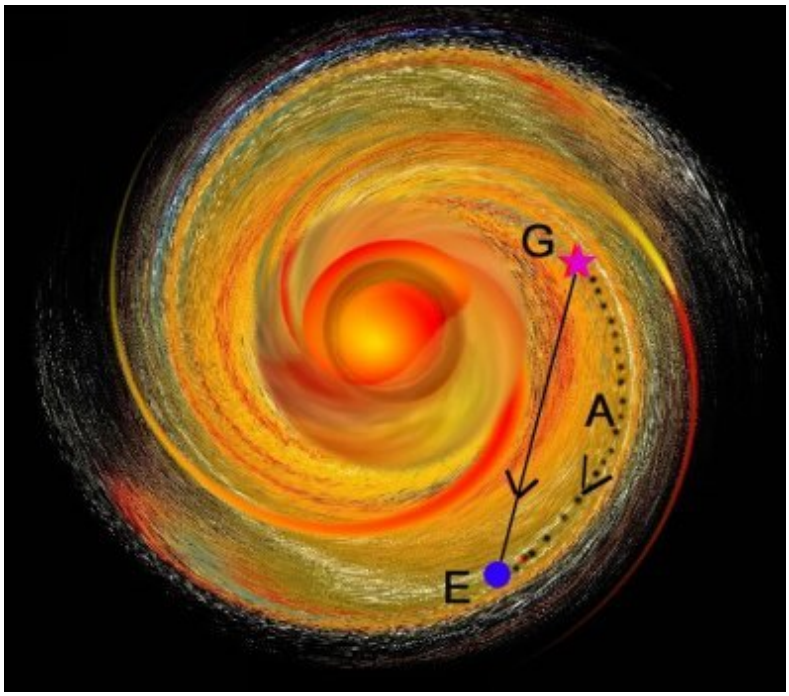


**Figure 9.10**: Furrows of background *aapah* between the spiraling arms of the universe.

The common phrase, "light travels in a straight line", breaks down in this scenario just as it breaks down in a curved glass fibre. Two primary optical effects are conceivable: (A) owing to the rarefied *aapah* furrow, the light from a faraway galaxy perceived on a straight path in fact could have travelled along the curved furrow and (B) the channeling of light in the furrow and the loss of its intensity owing to the absorption and scattering in the furrow's walls may create an illusion about the brightness of the galaxy.

When the light does not reach the observer in a straightforward manner it creates an optical illusion such as the mirage at a distance. One common optical illusion due to the light rays bending when the refractive index of the medium changes is the apparent bending of a pencil when dipped in water at an angle. The tip of the pencil is not seen where it exactly is. In the case of observing distant galaxies, as depicted in Figure 9.10, there is a possibility of *aapa*-furrows creating apparent displacement of an observed galaxy. If such a situation occurs, it is a 'mirage of the cosmos'.

Among the other two direct consequences of the curved path observation treated as a straight path observation could be (a) that the universe is not as big as it is presently observed and conceived in modern

Big Bang Hypothesis and (b) the observed red-shift (Doppler Effect) in the spectrum of a distant galaxy, used for determining the galaxy's speed of recession, could just be an 'optical illusion' because the receding distant galaxy in fact could just be receding away along a curved path created by the rotating universe and disappearing around the bend rather than flying away at exponentially increased speeds.

## (4). Curved Space near massive bodies has a Different Meaning

Einstein suggested that the Space around a massive celestial body is curved. The Space being an invisible entity cannot be directly detected or observed, however, the effect of its curvature on a beam of light can 'presumably' be discerned. The light travels in a straight line, but when it passes through the heavily curved space near a massive celestial body its path bends towards the massive body. It is like a parallax of a light ray in which the star on the line of sight is seen displaced from its actual direction. It may also be mentioned here that a ray of light would take a curved path when the refractive index of the medium (air density) changes on its path; an effect seen in the phenomenon of mirage. But the effect that Einstein put forward is said to be due to the curving of the Space (Space warping) owing to the enormous mass (gravity) of the body.

There are several points to make here. If the space is forced to curve in the vicinity of a massive celestial body, the Space must have the attribute of being affected by the gravity. Does the Space interact with gravity? May be it does but it is in contradiction with the Veda assigned attribute of *vapushkar* to the Space-entity discussed in detail in Chapter 5, Volume 1. The *vapushkar* attribute in Space-entity means that the Space '*keeps its form even when in use by a substance of any form*'. This author used the word

'presumably' for the Space curving in the vicinity of a massive body because that raises several queries. If the Space is affected by gravity, does it have mass of its own or what other attribute of the Space would interact with the gravity of a celestial body? For the Space to curve owing to the massive body, the Space must have the property of mass.

No one has postulated that the Space is made of matter or that the space has mass of its own. The Space (*Antariksh*-entity) according to the Vedic definition is an all-pervading entity which stretches without snapping, is *atoort* (without discontinuity), cannot be distorted or cut into pieces and is different from matter (Nature). If the Space could be pulled, pushed or distorted, it could be broken into pieces as well. Cosmologists/astronomers have not reported any observed chunks or islands of the Space-entity. Therefore the Veda assigned *vapushkar* attribute to Space seems to apply in a more meaningful way to the Space-entity than Einstein's suggestion that the Space could be forced by the gravity of a celestial object to curve around it.

Then what bends the light ray when it passes in the vicinity of a massive body? In the Vedic perspective, as understood by this author, the bending of a light ray near a massive gravitating body is not due to the warping of Space in its vicinity, but because of the extra concentration of the background *aapah*-field, the ubiquitous *tamah* (dark) *aapah*. As discussed above, the "vacuum" of Space is pervaded by the background *aapah*-field which also surrounds a celestial body. The *aapah* having mass in them the gravity of the body would create a differential *aapah*-distribution around the body; denser near the surface of the body and rarified higher up. The situation is similar to the air density distribution above Earth's surface.

In the Vedic perspective therefore, a photon takes a curved path near a massive body because of the differential refraction through the atmosphere of the celestial body. It is merely an optical phenomenon. This is similar to a light ray passing through a glass-slab having a refractive index higher than the air. The ray bends inside the glass slab and emerges out displaced from its original direction. It may be made clear here that the author is talking about the *Aapah*-field which exists even in the vacuum of space and not the air in the atmosphere of the celestial body.

The gravitational field around the celestial body is symmetric and under Einstein's premise the so-called curvature of the space and the gradients within the curved space around the celestial body must be symmetric as

well. Therefore the curvature of the space around the celestial body could bend the light rays symmetrically in its north, south, east or west. The fact is that all celestial bodies are in high velocity and that does not affect the curvature of the space in the vicinity of the massive body. In the Vedic premise however the photon transmission near a celestial body would be different if the body is in motion. This is because the *aapah*-field distribution around a body in motion would be drastically asymmetric as shown in Figure 9.11. So, may be the time has come for astronomers to rethink Eienstien's curving of Space due to gravity.

In the case of a stationary celestial body (golden colour) shown on the left, immersed in the non-reactive dark-*aapah* field, the light rays from a distant star passing through the *aapah*-field would first bend inwards and then bend outwards to emerge in a straight path. In the case of a body in high motion the *aapah*-field distribution around it would be drastically asymmetric as shown on the right of the Figure 9.11; darker areas represent higher density of the aapah-field. The approximate ray-tracing suggests that the light rays from the same star grazing in the front and the back of the body in motion would be seen from drastically different directions, as depicted.

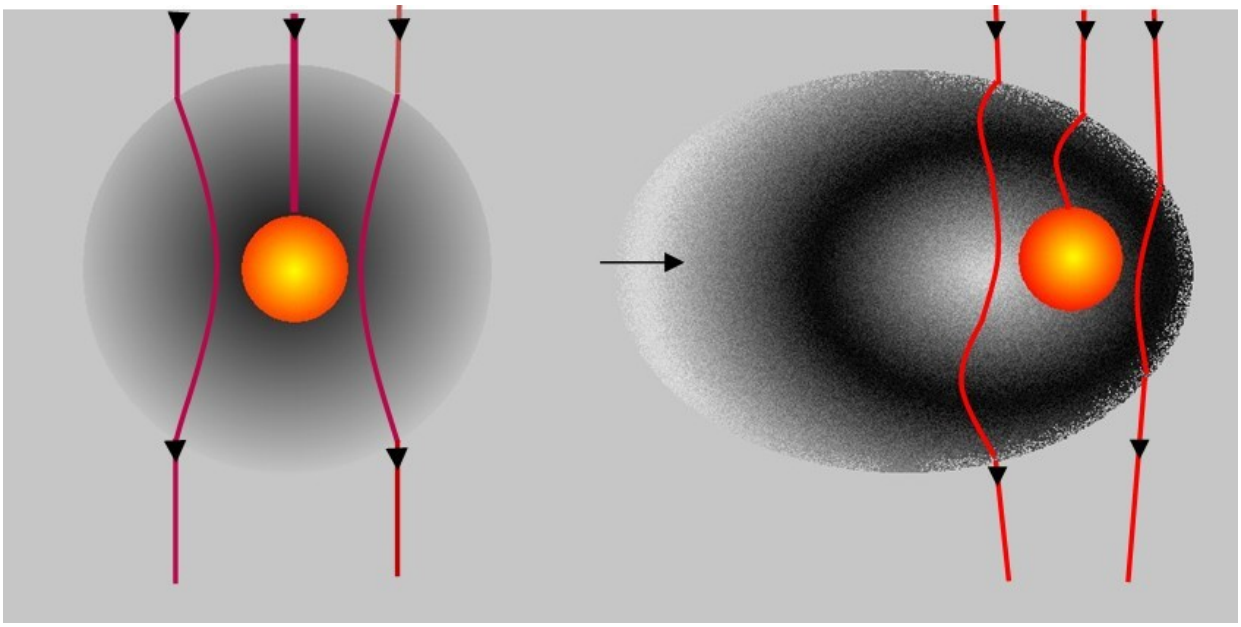

**Figure 9.11:** Left: Symmetric *Aapah* distribution surrounding a stationary celestial object. Right: Asymmetric *Aapah* distribution

surrounding a moving celestial object. Change in the refractive index would change the direction of the light rays.

Since all celestial bodies are in motion (the Sun revolving around the Milky Way Galaxy etc.) causing asymmetry in the *aapah*-field distribution around them, all the ray-bending observations should exhibit this asymmetry between the two sides of a celestial body, with a pronounced effect in the front and the back (Figure 9.11). That the Space-entity of the Veda is adorned with the attribute of *vapushkar* should be an interesting outcome of the astronomy observations of the asymmetric ray-bending in the front and the back of a moving celestial body; this is not due to the gravity of the celestial object reshaping the Space in its vicinity but due to the gravity of the celestial object reshaping the background matter distribution surrounding it.

There is always a possibility that the deductions that humans draw may change with time. It is too soon to conclude that *vapushkar* is not a universal property of Space.

The above discussion adds to the formulation of new postulates on **Space** and ***Aapah***, listed at the end of the Chapter 10.

It is remarkable that the Veda has not left the subject of the creation of the universe incomplete; it has also dealt with the fate of the universe in numerous mantras. Several of these mantras have already been presented and several more are presented in the following.

# CHAPTER 10: The Vedic Pralaya (dissolution) is the Big Crunch

One is bound to get wonder-struck with the enormity of the universe, regardless of which reference frame one chooses. The mantras indicate that the Vedic *rishis* grasped the fact that the universe was indeed vast, unfathomable and they expressed this in terminology enriching the subjects of physics, cosmology and astronomy. The origin of such Vedic thoughts in the distant past of the human civilization by itself is mind-boggling.

The fate of the universe according to the Vedic cosmology is in its *pralaya*, the complete dissolution into the undefined state of matter. Based on the vivid description in the mantra references the *pralaya* in Vedic cosmology is definitely a Big Crunch. The contemporary cosmologists have guessed about the fate of the universe but to the best of this author's knowledge the mathematical construct of the Big Bang Hypothesis does not indicate whether the universe will end up in a Big Chill, a Big Rip or a Big Crunch. This is because the nature of the Dark Energy responsible for expanding the universe is not known. The *pralaya* in Vedic cosmology, a term defined in Chapter 5, is a state of the universe opposite to the present state of the universe. That the *pralaya* is a real physical phenomenon in the Vedic thought, to which the Nature is subjected, is not something that evolved later in the post-Veda literature and philosophy, it is found captured in the Veda mantras from the very beginning. The *pralaya* in the Vedic mantras is not a connotation for a doom's day scenario to prepare humans for the eventuality but it is to educate humans about the knowledge of cosmology pertaining to the fate of the universe. The related mantra references delineate that the *pralaya* is that real physical phenomenon in which the entire Nature participates, right to its last *aapah*.

The Vedic principles on *srishti* and *pralaya* (creation, dissolution) are qualitative in nature. The quality of these principles however indicates that such conclusions could not have been drawn without a thorough mathematical treatment of the problem and experimentation in astronomical observation with high resolution. Theism aside, the residuum of the mantra at times being pure physics is quite intriguing, thought-provoking and can even be the source of valuable new possibilities in physics. The Vedic ideas are inspiring for a venturesome contemporary cosmologist/physicist who might look into them for interesting deductions; different from or similar to those drawn in modern cosmology. Based on deductions already drawn by this author here and the previous chapters of this book, some astronomers may be inspired to explain some unexplained observed phenomena by following fresh leads from the ancient cosmology.

In Chapter 5 the definition of the tri-root term ***ja-ga-ta*** (*jagata*) was discussed, It represents three actions by the universe - ***ja****ayate* (one that comes into existence), ***ga****chhati* (one that ends its presence, goes away) and ***t****ishthati* (one that persists) between the two states of the universe. It is the ***ga*** root that relates to the action of *pralaya* (dissolution). The term *pralaya* as the conjugation of the two terms *pra* and *laya* means (also discussed in Chapter 5) a '*definite process of disappearance in dissolution*'. Therefore in Vedic thought the *pralaya* is a logical phenomenon with certainty where the Nature dissolves itself into its causal state, the indefinable *Asata*-state of matter, to swing back again into the definable, useable (*Aditi*) *Sata*-state of matter to create the universe (*srishti*-phase).

There are numerous Vedic terms that indicate that the *pralaya* is not a one-time phenomenon. It is a definite, recurring, time-dependent phenomenon. Referring to *pralaya* the term तदानीम् (*tadaaneem*) in RigVeda (10/129/1) means "*then*" or "*during that time period*", the term तर्हि (*tarhi*) means – "*at that time"* and the term अग्रे (*agre*) in RigVeda (10/129/2) means "*prior to creation*". All these terms indicate that the *pralaya* is a time-dependent phenomenon. In RigVeda (10/129/7) the expression यदि वा न (*yadi vaa na*) signifying that "*when it will not exist*" also tells us that the dissolution phase in the Vedic cosmology is a reality. Implicit in all these expressions and the relevant mantras is that the Vedic creation is a cyclic phenomenon. The word *pralaya* is reserved in the Vedas and the Vedic Literature only for a specific state of the universe before and after a

creation. Now let us look at the process of *pralaya* itself as presented in the Veda mantras.

The YajurVeda mantra (23/56) in the expression **अजारे**[1] **पिशङ्गिला कुरुपिशङ्गिला** (*Ajaare pishangila kuru-pishangila*) addresses the Nature-entity as the **अजा**[1] (*Aja*), the sixth synonym of Nature in the Table 5.1 in Chapter 5. The term "*aja*" for the Nature means "*a real entity that is not an effect of a cause*". Implicit in it is the judgement that the Nature does not take birth, which means that it is an eternal entity. The action of *Aja* is expressed by the phrase **अजारे पिशङ्गिला कुरुपिशङ्गिला** (*Ajaare pishangila kuru-pishangila*) which translates into "***the Nature that swallows the universe at pralaya and the Nature that swallows all its cultivation and activity in the vast field of action* (Space-entity)".** This is a scenario of the universe returning into its indefinable space.

To differentiate the two eternal entities, the Nature and the Creator, the AtharvaVeda mantra (10/7/43) cited earlier, gives the ultimate credit to the Creator for the *pralaya* in Nature with another expression, उत् गृणत्ति (*ut granatti*), which also means the action of swallowing. The Nature swallows its own creation and the Nature itself is swallowed by the Creator. The detailed translation of this AtharvaVeda mantra was presented earlier.

The second part of the mantra relevant to the subject of *pralaya* states:

> "*…The Creator weaves this network* (of cosmos) *and swallows it* (at the end of creation). *The Creator spreads it and supports it on the back of the Space-entity"*. (AtharvaVeda, 10/7/43).

Whereas this AtharvaVeda mantra (10/7/43) has addressed the Space-entity as the नाकः। (*naakah*) for it is a container of all cosmos (synonym 13 in Table 5.6 in Chapter 5), the YajurVeda mantra (23/56) cited earlier has addressed the space to be a **कुरु** (*kuru*) (synonym 11 in Table 5.6 in Chapter 5). The term *kuru* stands for "*a vast farm for cultivation, growth and action*". This "*vast farm for cultivation, growth and action*", where all Nature's actions take place and where Nature creates the universe is the Space-entity. In the likeness of a farmer cultivating a crop in a big tract of land, the Space-entity is Nature's farm for all its actions leading to the

cultivation of the universe. The phrase **अजा पिशङ्गिला कुरुपिशङ्गिला** (*Ajaa pishangila kuru-pishangila*) in the YajurVeda mantra (23/56) indicates that the *pralaya* is an action of the Nature in which all cosmos, the cultivation of the **अजा** (*Ajaa* = Nature) in the **कुरु** (*kuru* = the *vast farm…*), the spread-out Space-entity, are all swallowed by the Nature. When all activities in space and the celestial objects cease to exist and matter becomes completely non-active, that is the state of the *pralaya* in Nature.

The action of *pralaya* is expressed by the process of swallowing (**पिशङ्गिला** = *pishangila*). It was also mentioned earlier that at the time of creation the '*Nabha*' (Space-entity) rises out of the *naabhi* (navel or centre) of the Creator. The Creator spreads it to its vastness and all cosmos are in नाके। (*naake* = in the Space or supported on the Space). All these references point to the fact that the universe existed in the *pralaya* phase in a different and indefinable state before springing forward into the creation phase. Implicit in Nature's action of **पिशङ्गिला** (*pishangila* = swallowing) is that the *pralaya* in the material realm is when the Nature swallows itself and in the spiritual realm the *pralaya* is when the Creator swallows the creation (Nature).

A part of the RigVeda mantra (10/190/3)**,** presented with full translation and interpretation in the Chapter 6 on "Vedic Cosmology Principle", is recalled here to show that the mantra explicitly states the cyclic nature of the Vedic universe,

> *"The Creator and upholder of this universe has created in this **kalpa** all-illumine cosmos….and the other objects such as the Sun, the Moon and the Earth and will continue in future the cycle of creation in a semblance of the previous **kalpa**."* (RigVeda:10/190/3).

The emphasis in this mantra is on previous epochs of creation and that the cyclic process will continue eternally. In this mantra obviously, there is no time t = 0 second as in the contemporary Big Bang Hypothesis. Now we present two RigVeda mantras with word meanings and translation that depict the process of *pralaya*, the dissolution of *jagat* (universe),

पत्तो जगार प्रत्यञ्चमत्ति शीष्र्णा शिर: प्रति दधौ वरूथम् ।
आसीन ऊर्ध्वामुपसि क्षिणाति न्यङ्ङुत्तानामन्वेति भूमिम् ॥

(RigVeda, 10/27/13)

**Transliteration:**

"*Patto jagaar pratyanchmatti sheershnaa shirah prati dadhau varootham ।*
*Aaseen oordhvaamupasi kshinaati nyangunttaanaamanveti bhumim ॥*"

**Word Transliteration and Translation**

पत्त:(*pattah*) = The Creator , जगम् (*jagam*) = swallows the *jagata*, प्रत्यञ्चम् (*pratyancham*) = reversal of 'effect' into its 'cause', अत्ति (*atti*) = receives/consumes/procures, शीष्र्णा (sheershna) = situated on higher side/elevated apportionment, शिर: (*shirah*) = upper part (of the Nature in this context), प्रति दधौ (*prati dadhau*) = possesses/upholds, वरूथम् (*varootham*) = clusters of atoms / cellestial bodies / abode / cluster of specific things (all meanings apply) ।
आसीन: (*aaseenah*) = being present, ऊर्ध्वाम् (*oordhvaam*) = those present in the upper direction , उपसि (*upasi*) = in proximity / pervading, क्षिणाति (*kshinaati*) = weakens them, न्यङ् (*nyang*) = from below, उत्तानाम् (*uttaanaam*) = expanded / grown-big. अनु एति (*anu eti*) = makes them their follower, भूमिम् (*bhumim*) = to the Earth ॥

**Mantra Translation:**

*"Establishing the jagata (creation) the Creator upholds varootham, the 'clusters of atoms' in all elevated apportionments of Space and swallows them in pralaya (dissolution). Reversing its 'effect' into 'cause', the Creator procures Nature back into its causal-form. While pervading in them He weakens the cosmos in upper direction and makes the ones in lower direction their followers from below, including the grown-big Earth."* (RigVeda, 10/27/13).

The mantra translation is self-explanatory; a few words need elaboration. The term प्रत्यञ्च (*pratyanch*) in common (*rudhi*) meaning pertains to the reversal of action or the reversal of force or the reversal of cause-effect. A common example of *pratyanch* is the action of a bow and arrow. Pulling of the bow-string is the 'cause' that stores the force in the bow and the transfer of this force into the arrow creating the motion in the arrow when released, is the 'effect'. This process is प्रत्यञ्चम् (*pratyancham*) where the reversal takes place in an object or a force. As emphasized in Chapter 4, the context is most important in Vedic translations. All Vedic terms are *yaugik* as opposed to *rudhi* (colloquial). Therefore, the *yaugik* meaning closest to the root of the term is to be used rather than its *rudhi* meaning; the latter only pertains to a tangible object, the arrow in this example. The *yaugik* meaning of the term प्रत्यञ्चम् (*pratyancham*) in the context of the above mantra and the other mantras in the *sukta* 27 of RigVeda's chapter 10 stands for the reversal of the "effect" into the "cause". The universe is the "effect" and the indefinable *Asata*-state of matter is its "cause". The *pratyancham* of the universe therefore suggests that the process of the creation of the universe 'reverses' where the stored energy is released. An additional deduction from this mantra is that the universe in the Vedic thought reverses into a Big Crunch and decidedly does not keep expanding towards a Big Chill or a Big Rip. Therefore, the term जगम् (*jagam*) in the above mantra signifies the first two of three roots (first two syllables) forming the tri-root conjoined word जगत (*ja-ga-ta*). The *ja* and *ga* respectively stand for "creation" and "dissolution".

The other important term in the mantra is *varootham* which translates into '*cluster of atoms*'. The Sanskrit dictionary meanings of this word, among several closely related meanings are: 'group of specific things', 'an assemblage' or 'multitude'. In the ancient Nighantu (word list) cited in Yask Rishi's Nirukt Sutra (3/3), among 22 synonyms for the word गृह (*griha* = abode), the 17th is *varootham*. Within the context of the mantra and in the context of the other terms in the same mantra, the term *varootham* stands for all the abodes in space which are the celestial bodies with terrestrial support.

The term *varootham* in the translation of the RigVeda commissioned by the Arya Pratinidhi Sabha (a Vedic Organization of Aryan Societies) that follows the Sanskrit discipline of Swami Dayanand Saraswati stands for '*assemblage of atoms*'. The assemblage of atoms creates a celestial body and the assemblage of cosmos forms the entire universe. Therefore, the mantra stands for the assemblage of celestial bodies distributed in all directions of space. This is the meaning being reflected in the mantra translation. This is also consistent with several mantras including the RigVeda mantra (10/129/5) from its creation *sukta* where रेतोधा आसन्महिमान (*retodha aasanmahimaana*) translates into - "*These fundamental seeds of matter are the cause for great objects of the cosmos"*. The assemblage of the atomic form of matter is also the basic principle of the present cosmological theories for the formation of the galaxies and the astronomical objects in them, including other substances along with the living matter. All cosmos according to the Vedas have their beginning at the atomic level leading to conglomeration into *mahaan* (gigantic) objects. This by itself is a remarkable Vedic observation.

It is clear from the meaning of the mantra that the reverse of what was said in the *Bhavavrittam sukta* on the creation of the universe occurs in *pralaya* where the matter in existence (effect) reverses into its 'causal' state. The above mantra presents a vivid picture of the process in which all cosmos from all directions start to weaken and are drawn together to be confined in a diminutive space leading back to the starting Space labeled *tuchchhaya* (diminutive space) in the *Bhavavrittam sukta*. Also in the simile of the swallowing of the universe by the Creator, discussed earlier, the spread-out matter of the universe has to come together to be confined in a smaller place. Therefore, the *yuvati* representing the *Aapah*, having the

property of mass (gravitation), gathers the web of cosmos and wins over the second *yuvati* (centrifugal force due to rotation of the universe) busy expanding the web of cosmos. This also means that the rotation of the 'wheel of the universe' slows down. Implicit in the mantra's deduction is that the universe's central *Skambha* runs out of energy leading to the collapse of the universe.

While discussing the term *Purush* for God it was mentioned in Chapter 5 that God in the Vedas is addressed in all three genders - masculine, feminine and neutral. In the following RigVeda mantra (10/27/14) God is addressed as a "mother of creation". The most fascinating feature of the mantra is the clever allegory wherein God is said to be giving birth to "***someone else's pregnancy***". This someone else is none other than the Nature-entity.

वृहन्नच्छायो अपलाशो अर्वा तस्थौ माता विषितो अत्ति गर्भः ।
अन्यस्या वत्सं रिहती मिमाय कया भुवा नि दधे धेनुरूधः ॥
(RigVeda, 10/27/14)

**Transliteration:**

"*Vrihannachchhaayo aplaasho arvaa tasthau maata vishito atti garbhah ।*

*Anyasyaa vatsam rihati mimaaya kayaa bhuvaa ni dadhe dhenuroodhah ॥*"

**Word Transliteration and Translation:**

वृहत् (*vrihat*) = Having existence up to great distances, अच्छायः (*acchhaayah*)=one that is devoid of darkness, अपलाशः (*apalaashah*) = un-ageing / immortal , अर्वा (*arvaa*) = one that creates motion in all, तस्थौ (*tasthau*) = is in existence, माता (*maata*) = mother/the Creator, विषितः (*vishitah*) = omnipresent , अत्ति (*atti*) = receives / consumes / procures , गर्भः (*garbhah*)=conception / pregnancy ।

अन्यस्याः (*anyasyaah*) = of another, वत्सं (*vatsam*) = of the progeny, रिहती (*rihati*) = act of liking a new born / kissing, मिमाय (*mimaaya*) = creating again, कया (*kayaa*) = blissfully, भुवा (*bhuvaa*) = by coming into existence, नि

दधे (*ni dadhe*) = upholds, धेनु: (*dhenuh*) = nourishing Nature /caring Creator / cow , ऊध: (*udhah*) = to the creation ॥

**Mantra Translation:**

> *"The greatest, the one devoid of darkness, immortal, animator of all, exists as the omnipresent virtuous Mother (the Creator of all). This Mother procures back (in pralaya epoch) her creation, again conceives it and gives birth to the pregnancy of another mother of different nature (inert Nature). The virtuous Mother provides caring nourishment and expresses her love to the progeny like a cow licks her calf. She upholds this blissful creation."* (RigVeda, 10/27/14).

The allegory in this mantra relates to two mothers with differing qualities giving birth to one and the same pregnancy. This allegory is unique because two different mothers cannot give birth to one progeny. Who are these two mothers? One mother is the Mother God and the other mother is the Mother Nature. The first line of the mantra has defined the first mother with several virtues that are present in the conscious-being Creator and the first word of the second line अन्य (*anya* = another) indicates that the second mother is someone else with different virtues. Also the mantra talks about the *pralaya* (dissolution) and creation. Therefore, by deduction the second mother is the inert entity – the Mother Nature. The one and the same child of the two mothers is the 'creation'. The 'creation' is the progeny of the Mother Nature and because the Vedas are theistic and credit all 'creation' to the omnipresent Creator, it is also the child of the Creator. The context being giving birth, the Creator is addressed here as a mother. This mother is said to express love and provide nourishment to the progeny like a mother does.

The reason this mantra is included here is that within it alone two processes are mentioned – the dissolution of the creation wherein the Mother Creator procures back the creation and gives birth to it again. Through this mantra one also gets the benefit of a ***very interesting allegory wherein one mother carries another mother's pregnancy***; which otherwise is not natural in the creation. In the *Deva sukta* of RigVeda, presented earlier in this chapter, it was said that the creation of the universe is from the Golden-embryo which is *Aditi*'s (Nature) pregnancy out of which the universe is created. Therefore, between the two mothers in the allegory one is the conscious-being Creator conceiving the child (the universe) of *Aditi*.

RigVeda's chapter 10, *sukta* 8 is the *Agni sukta* where *agni* stands for energy. This is equivalent of saying that it is the *Energy sukta*. So that it is not thought that only the observable cosmos disappear in *pralaya* while the energy forms of matter continue, the 3rd mantra of this *Agni sukta* states that in *pralaya* the *Agni* also goes back. The Creator-mother procures back all forms of the *Sata*-matter, energy forms included as in the mantra below:

आ यो मूर्धानं पित्रोररब्ध न्यध्वरे दधिरे सूरो अर्णः ।
अस्य पत्मन्नरुषीरश्वबुध्ना ऋतस्य योनौ तन्वो जुषन्त ॥

(RigVeda, 10/8/3)

**Transliteration:**

"*Aa yo moordhaanam pitro ra rabdha nyadhvare dadhire sooro arnah* ।

*Asya patmann-rusheer-shvabudhnaa ritasya yonau tanvo jushant*।।"

**Word Transliteration and Translation:**

यः (*yah*) = this (for *agni* = energy), पित्रोः (*pitroh*) = the region between Earth and *Dyu* (brilliant space above), मूर्धानं (*moordhaanam*) = upper region, आ ररब्ध (*aa rarabdha*) = creates and upholds, सूरः (*soorah*) = vibrant/of dynamic nature, अर्णः (*arnah*) = high speed, नि दधिरे (*ni dadhire*) = property of all substances, अध्वरे (*adhvare*) = in the yajna of creation, the universe ।

अस्य (*asya*) = of this, पत्मन् (***patman***) **= decline / diminution / pralaya / dissolution**, अरुषी: (*arooshi*) = effulgent, अश्वबुध्ना: (*ashvabudhnaa*) = all tied in motion, ऋतस्य (*ritasya*) = law of creation, योनौ (*yonau*) = in the causal state of Nature, तन्व: (*tanvah*) = all celestial objects, all matter, जुषन्त (*jushanta*) = complete dissolution ॥

Mantra Translation:

> *"The vibrant agni (energy), that creates and upholds the Earth and the upper expanse of the brilliant cosmos* (पित्रो: = *pitroh*) *is the cause for dynamics and high motion in all substances in this creation* (अध्वरे = *adhvare*). *On its decline* (अस्य पत्मन् = *asya patman*), *all effulgent celestial bodies and substances* (तन्व: = *tanvah*) *of the creation bound by enormous speeds, vanish* (जुषन्त = *jushant*) *into the material-cause* (योनौ = *Prakriti*) *under the law of creation* (ऋतम् = *ritam*)." (RigVeda, 10/8/3).

The mantra states that a time comes in the life of the universe when the energy that creates the brilliant objects of the universe and is responsible for the high degree of dynamics in all substances, declines. This decline in energy leads to the complete dissolution of the universe to the degree that it reverses into the योनी (*yoni*), the state of the Nature that is in the causal-state of matter. The mantra basically depicts the commencement of the *pralaya* scenario with the emphasis that the weakening of the energy of the system leads to the *pralaya*. The entire universe begins to collapse reverting into the *Asata-state* of matter. The *Asata*-state of *Prakriti* (Nature) is addressed as *yoni*, signifying the Nature at the causal-state wherein the matter is indefinable and beyond comprehension.

The theme of the mantra is far from the subject of spirituality and is closest to the theme of physics. The mantra from the *Agni sukta* is expected to emphasize 'energy', denoted earlier by the symbol $\mathbf{E_h}$. The only deduction from this mantra is that the energy (*agni*) that creates the celestial bodies and creates enormous dynamics in objects, the source of effulgence in cosmos, ultimately declines at the time of the *pralaya*, causing a complete collapse of the universe. This scenario may not be close to what the modern physics and cosmology hypothesize, nevertheless, it reflects an ancient thought in physics. Regardless of what mechanism creates a decline in the energy of the universe, the deduction of the mantra is logical because the universe has no other choice but to collapse if the energy of the universe declines.

The emphasis under the Vedic Creation Scenario of this chapter has been that the entire universe is in the rotational dynamic equilibrium and that all effulgent galaxies and the celestial bodies within them are in enormous dynamic state preventing the universe from collapsing under its own gravity. This mantra's emphasis is that the energy that sustained the universe ultimately weakens, causing all substances of the universe to dissolve into its causal-state from which the creation began. Thus, according to the Vedic scenario, the fate of the universe is in a Big Crunch.

## Rajo-Guna - the Gravitation Leads to the Pralaya (dissolution)

The three fundamental properties (*gunas*) of matter, *sato-guna, rajo-guna* and *tamo-guna* were discussed in Chapter 5 under the sub-headings of 'Vedic Triune Atom' and 'Physical Aspects of the Triplet' under the main heading of 'The Nature-entity (*Prakriti-tatva*)'. Based on Vedic references it was stipulated that it is the *rajah* property (*rajo-guna*) out of the three that manifests as the active matter and energy of the universe. Whereas one *rajah* phase of the fundamental tri-property *aapah* creates energy forms, the other *rajah* phase creates matter in the form of fundamental particles bigger than the *sata, raja* and *tama* atoms and the observable matter in general. It

was also discussed in Chapter 5 that the *Aapah-devata*, the third out of the 7 primary *devatas* listed earlier, is an all pervading matter field out of which the fundamental forms of matter arise. Whereas the *rajah* component of the *Aapah* is dominantly confined in the effulgent cosmos, the *tamah* component is ubiquitously spread out through the vacuum of the Space.

The *rajah* is the property of the active and reactive component of *Aapah* and therefore is an adjective to the matter that is observable in the form of substances and energy in the universe; the resplendent cosmos being the overwhelming display of the *rajah* matter. Of the several Veda mantras, just two RigVeda mantras (7/80/1-2) are presented in the following that tell us that it is the invisible *rajasi*-force (force arising out of *rajah aapah*) that brings *pralaya* to the universe. Of the two opposing forces in the universe, one causing contraction of the universe and the other causing expansion, discussed in terms of the simile of the two *yuvatis*, the *yuvati* gathering the web of cosmos, is the *rajasi*-force; the force due to the mass in matter, which is gravitation.

Recall that the observable universe was created out of the *Maart-aand* the Great-ovate with 'earthly' properties. It was this agglomeration of *rajo-guna aapah* that formed the galaxies and the celestial bodies in them when Nature hurled the *Maartaand* (the 8th progeny) through the vast space. It is the same spread-out matter in the form of cosmic objects that are pulled together bringing an end to the universe. The mantras explicitly state that the *rajo*-property of matter starts to collapse the universe, '*…from above, from below, including the Earth*'. Two mantras pertaining to the *rajasi*-force are discussed below.

प्रति स्तोमेभिरुषसं वसिष्ठा गीर्भिर्विप्रास: प्रथमा अबुध्रन् ।
विवर्तयंतीं रजसी समंते आविष्कृण्वतीं भुवनानि विश्वा ।।

(RigVeda, 7/80/1)

**Transliteration:**

"*Prati stomebhirushsam vasishthaa geerbhirvipraasah prathma abudhran |*

*Vivartyanteem rajasi samante aavishkrinvateem bhuvanaani vishvaa ||*"

**Transliteration and Word Translation** (words sequenced as in English sentences)**:**

आवि: कृण्वतीं (*aavih krinvateem*) = when created (while creating) भुवनानि (*bhuvanaani*) = all celestial bodies/cosmos , विश्वा (*vishvaa*) = of the entire universe, प्रति उषसं (*prati ushasam*) = in every early morning during *usha* period before sunrise (dawn, morning-twilight), प्रथमा (*prathma*) = first, अबुध्रन् (*abudhran*) = erudite or enlightened, स्तोमेभि: (*stomebhih*) = recited mantras for others' intellectual benefit, वसिष्ठा, गीर्भि (*vasishtha, geerbhih*) = to those scholars with exceptional intelligence , विप्रास: (*vipraasah*)= the brahmans with deep knowledge of the Vedas, **रजसी (*rajasi*) = the force of rajo-guna / the force owing to matter / force of gravity,** विवर्तयंतीं (*vivartyanteem*) = reverses entire universe into *pralaya*, समंते (*samante*) = when its end comes ॥

**Mantra Translation:**

*"When all cosmos of the entire universe are created, the first enlightened rishis give its knowledge through the mantras for the benefit of those with exceptional intelligence that devote themselves in mantra recitation during the early morning period before sunrise. When the end comes (pralaya), the* रजसी (*rajasi*) *force of matter (gravity) sends the entire universe into pralaya"* (RigVeda, 7/80/1).

The first part of the mantra states that when the universe is created, the knowledge regarding creation is also bestowed in the minds of enlightened *rishis*. According to Vedic philosophy these first *rishis* are inspired in their meditation to impart the knowledge of creation through the mantras to those devoted scholarly people who meditate and carryout mantra recitation on a regular basis from the early morning. They in turn disseminate the knowledge of creation by reciting mantras selflessly for the benefit of the others. Implicit in the above mantra is the thought that just as an artisan wants others to know as soon as possible about his art, the artisan of the

creation wishes to impart the knowledge of the creation through the enlightened humans.

Vedas propound that the consciousness in matter is due to the presence of the conscious-being soul (quantum of consciousness) in it and that the different souls are at differing levels of enlightenment (spiritual evolution) and are all available at the time of creation to take birth in physical bodies at their individual level of consciousness evolution carried forward from the previous creation. The highly enlightened souls, as early in the history of creation as the universe can sustain living-beings, impart knowledge of the creation to other highly disciplined and intelligent humans. These highly enlightened souls are called the *aapt-purush* and those who propagate knowledge further in general are called the *rishis*. They are called the *rishis* for "*they impart knowledge selflessly to others for the benefit of the society*".

Obviously the evolution of the species in the Vedic creation is not Darwinian. In Darwinian evolution the process for knowledge development and dissemination began only when humans appeared on the Earth. Scientists estimate that the humans appeared on the Earth about 100 MY ago. This means that in the process of knowledge development and knowledge transfer nothing worthwhile happened for a period of 13.7 BY in the universe's life of 13.8 BY! Also, this would suggest that the humans did not evolve enough until the last few centuries to come up with cosmological theories on the universe, as good as the modern Big Bang Hypothesis! Out of such intellectual stagnation for most of the universe's life the human intelligence springing up suddenly in the past few centuries is mind-boggling and incredible. According to the Vedic philosophy, as soon as the livable conditions on Earth and on other terrestrial bodies in the universe are established, the consciousness at all levels of its pre-existing evolution at the end of the previous creation emerges in this creation. The full spectrum of spiritual evolution in living-being species, including the वसिष्ठा, गीर्भि (*vashishtha, geerbhih = the scholars with exceptional intelligence*) and the विप्रास: (*viprasah = the brahmans with deep knowledge of the Vedas*) is available in the universe for knowledge development and dissemination.

The second part of the mantra has direct relevance to the topic at hand, the *pralaya* of the universe. The cause for *pralaya* in the mantra is रजसी

(*rajasi*) the force due to *rajo-guna*, owing to the *rajah*-property in matter. In the RigVeda mantra (10/129/5), discussed under the Vedic Cosmology Principle, the important term *retodha* in the expression रेतोधा आसन्महिमान (*retodha aasan-mahimaana*) represents the most fundamental particles of matter that serve as the seeds of *mahimaana* the great celestial bodies. The *retah* in Saankhya Philosophy of Rishi Kapil stems out of the *rajah* property of Nature. This establishes within the Vedic frame of reference that the रजसी *(rajasi)* is the force of attraction between the celestial bodies that starts to bring the universe together, weakening the force of *Vaayu-devata* that was causing them to fly apart, creating the expansion of the universe. The *rajasi* force mentioned in the mantra is the force of gravity that leads the universe to *pralaya*, the Vedic Big Crunch.

This section is concluded by presenting a mantra which brings in the theism of the Veda and states that ultimately it is the pre-existing unseen creation energy of the Creator that bringing the universe into its creation phase, sustains it and finally it is withheld, leading to the *pralaya*; with creation energy remaining unchanged and unexhausted.

एषा स्या नव्यमायुर्दधाना गूढ्वी तमो ज्योतिषोषा अबोधि ।
अग्र एति युवतिरह्रयाणा प्राचिकितत्सूर्यं यज्ञमग्निम्॥

(RigVeda, 7/80/2).

**Transliteration:**

"*Esha syaa navyamaayurdadhaanaa gooddhvi tamo jyotishoshaa abodhi |*
*Agra eti yuvatir-arhayaanaa prachikitatsooryam yajyamagnim* ॥"

**Transliteration and Word Translation:**

एषा गूढ्वी (*esha gooddhvi*) = this mysterious energy, नव्यं, आयु: , दधाना (*navyam, aayu, dadhana*) = ever-renewed / never-ageing, त्या (*tya*) = that energy, तम: ज्योतिषा (*tamah jyotisha*)= from darkness to light, उषा अबोधि (*usha abodhi*) = making us cognizant in *usha* the beginning |

अग्रे (*agre*) = (appears) in the beginning (reference to the creation of the universe), एति (*eti*)= returns/disappears/dissolves back (reference to dissolution), युवति अह्रयाणा (*yuvati arhayaanaa*) = self-energized young

female (energy), प्र (*pra*) = very well, अचिकितत् (*achikitat*) = creates, सूर्यं, यज्ञं, अग्निम् (*sooryam, yagjyam, agnim*) = the Sun, the process of creation, the energy ॥

**Mantra Translation:**

> *"From the observation of the* उषा (*usha*), *the early morning dawn, comes the cognition of the dawn of the creation that was brought about by the mysterious ever-renewed energy (of the Creator), bringing the creation from the darkness to light. This first mysterious energy creates the Sun* (सूर्यं = *sooryam*) *and the energy* (अग्निम् *agnim*) *making us cognizant of the creation process* (यज्ञं = *yagjyam*). *It creates the perfect universe like a self-energized dynamic youthful female (yuvati) with ever-renewed youth, the universe that disappears back into pralaya."* (RigVeda, 7/80/2).

There are several points to note from the mantra. This energy of creation is said to be mysterious (गूढ्वी = *gooddhvi*). The term *gooddhvi* (गूढ्वी) for energy means the one not observed or experienced with senses, like the other physical energy forms. To differentiate this unique energy from a physical energy, the term अग्निम् (*agnim*) for the heat-form of energy ($\mathbf{E_h}$), has also appeared in the same mantra. *Agnim* the heat energy in the mantra is used here in association with the Sun and the process of creation. All physical energy forms, including the heat energy, are the subject of senses, but this *gooddhvi* (गूढ्वी) *mysterious ever-renewed energy* is the one that this author named in this book as the Creation Energy. As discussed before, the Creation Energy is associated with the conscious-being Creator's *Eekshana* (resolve to create) and His *Munn* (Mind-entity), this author denoted it as $\mathbf{E_{e\text{-}m}}$ and differentiated it from the physical forms of energies, heat ($\mathbf{E_h}$) and rotational kinetic energy ($\mathbf{E_r}$). This mantra assigns the Creator for creating the universe and for bringing *the creation from the darkness to light*.

Whether the energy is from a source that is consciousness or purely physical, it must interact with matter for the energy to be meaningful. When interpreted from a purely physical perspective the mysterious *gooddhvi* energy of this mantra must be the gravitational energy, the action (effect) of

that is seen but is not sensed by the senses. As discussed earlier, the *agni* energy is responsible for the explosion in the Golden-embryo and for spreading the cosmos but it does not bring them back together. Just as a living-being's *eekshana* energy with desire to create something tangible remains mysterious for others till an action is exhibited, the high likelihood is that the *rishi* in the mantra is referring to the Creator's mysterious *Eekshana* power that creates the perfect universe.

Another most interesting feature of this RigVeda mantra is the simile of a mysterious energy with an ever-youthful *yuvati* (female) that takes part in the creation. Recall the two *yuvatis* of the AtharvaVeda mantras; one engaged in gathering the 3-dimensional web of cosmos and the other in spreading it. While considering these mysterious forces one has to keep in mind that the *rishis* of the Veda had recognized the existence of gravity. This was mentioned in the Chapter 1 and is discussed in greater detail in Chapter 8 under the sub-heading, "The Earth". The emphasis of the above mantra is that it is the invisible गूढ्वी (*goodhvi* = mysterious) nature of the force that makes it distinct from other forms of energies.

The expression 'ever-renewed' or 'never-ageing' for Nature's special energy is the virtue assigned to the *yuvati* representing the gravitation property of the matter of the universe. This is a Vedic way of stating that because the matter in the universe is conserved, its gravitation is conserved as an un-ageing force. Also the mantra states that this energy appears at creation and disappears at dissolution, indicating the transition of matter from *Sata*-state during its creation phase back into *Asata*-state, the indefinable state of Nature during its dissolution phase.

# Important Deductions from Chapters 7 to 10:

(1). For the universe to come into existence the Nature transits from non-descript inactive state of matter (*Asata*-state) in the interior of the Creator-energy field into a physical active state (*Sata*-state) resulting into the entire population of cosmos of the universe. (RigVeda, 10/129/1-7; AtharvaVeda, 10/8/13).

(2). The universe is not a random phenomenon with chaos. The properties of matter and the laws of physics, not creatable by humans make the universe a planned process with 'causal-form' of 'non-being' matter (*Asata)* transiting into 'effect-form' (*Sata)* of 'being'. (RigVeda, 10/72/2).

(3). A group of seven *deva*-energy-fields is first created by *Aditi* (Nature) in the beginning of creation that become a ubiquitous permanent feature of the universe up till its dissolution in *pralaya*. (RigVeda, 10/72/1).

(4). In the beginning, the embryo of the universe, the *devas* and the cosmos, all exist in togetherness in the form of primordial fundamental atoms of matter called the tri-property *Aapah,* concentrated in the navel (centre) of the Creator Energy field. (RigVeda, 10/82/6).

(5). All seven *deva*-energy-fields are non-exhaustive quantized physical energy fields. They are created sequentially in near-simultaneity. The *Mahata*-energy-field, the first *devata*, is the subtlest physical phenomenon in the universe, others being in a sequential degenerate state of the previous. The first two *devatas*, the *Mahata* (Intellect-element) and the *Ahankaara* (Ego-element) operate in the spiritual realm (metaphysical), interact with matter and manifest through the living-beings. The other five *devas* in the physical realm are physical matter/energy fields that affect matter and are part of matter. Therefore they enable their detection by means of instruments made of matter (RigVeda, 10/72).

(6). The pre-existing Space-entity confined in *tuchchhaya* (diminutive) space is expanded by the seven *deva*-fields created first by the Nature. The Space-entity is stretched out in all directions for the primordial matter to spread out through the

universe to form the observable cosmos and minute matter/energy of the universe (RigVeda, 10/72/6-7).

(7). After the 7 *devas* the Nature creates its 8th progeny (Herself) called the ***Maart-aand*** (Mortal-ovate) in the shape of a spheroid. The primordial ovate of matter in *paryaplav*, floats for a period of one *deva-yuga* of 4.32 MY when it develops tremendous heat energy and angular momentum leading to an enormous explosion in it, filling the universe *far-and-wide* with ever-evolving sub-ovates to form celestial bodies (RigVeda, 10/72/7-8).

(8). The functioning universe with cosmos is established. The Earth establishes the directions and reveals the vegetation-life in the first *deva-yuga* (4.32 MY). Then the conscious-beings (*daksh*) with physical body (form) are revealed (RigVeda, 10/72/3, 4).

(9). The ubiquitous *devas* the '*amrit-bandhu* (*brothers-in-immortality*) of the conscious-being, function through the physical body of conscious-beings establishing the matter-consciousness relationship (RigVeda, 10/72/5).

(10). The universe is a rotating wheel-like system giving rise to the possibility of a giant rotating spiral in the form of a spiral-galaxy (AtharvaVeda, 10/8/7).

(11). Despite the diversity in cosmos the physical universe is one dynamic system governed by the *same laws of physics throughout* and the metaphysical universe with consciousness plays its own role within its own laws (*satyam* and *ritam*) (AtharvaVeda, 10/8/7).

(12). The observable matter of the universe is half of the total, the other half being non-observable matter is in *deva* matter/energy forms (RigVeda, 1/164/36).

## New Theorems by the Author:

(1). Absolute Zero Temperature

*"The property of motion being an inherent nature of matter* owing to the tri- *property of sata, raja and tama being active during the creation-phase of the universe, a True Absolute Zero Temperature is unreachable."* (Shiv Raj Pal, 2008).

(2). Matter-Manifestation

*"Matter in the creation phase of the universe manifests with the inherent property of motion (Vaayu-devata) which is revealed through rotation and revolution at all its levels and the Vaayu-devata ceases completely in the dissolution phase of the universe".* (Shiv Raj Pal, 2013).

(3). Endowment of Rotational Motion

*"The root-cause of the rotational motion in all Celestial Objects and Galaxies in the universe is an endowment from the*

*initial rotational momentum in the primordial universe"* (Shiv Raj Pal, 2013).

(4). The Cause for expansion of the universe

"*The inherent rotational momentum of the universe is the cause for the expansion of the universe and not the hypothetical Dark Energy*". (Shiv Raj Pal, 2013).

(5). Vapushkar Property in Space

**"***The vapushkar property of the Space-entity negates the postulate in general relativity that the gravity is the cause for curving of space in the vicinity of a massive celestial object. The apparent curving of space is due to the the refractive index of space caused by the ubiquitous Aapah background field."* (Shiv Raj Pal 2016).

(6). Universe in Two Opposing Oscillatory Energy Fields

*"The universe during the creation phase is embedded in two opposing oscillatory energy fields of different natures with time-periods of cosmological scales, one energy field being the gravity and the other the inherent angular momentum"*

*(Shiv Raj Pal).*

(7). All forces Accompany their Compression Wave

*"All forces transmit through their compression wave that they create in the medium of the ubiquitous Aapah background that serves as the viscosity of the medium and acts as the moderator for the speed of the force"*.(S.R. Pal, Nov 2017).

# CHAPTER 11:
# Functioning Vedic Universe – Birth of the Solar System and the Ancient Observations of the Sun and the Planets

पूर्वापरं चरतो मायय्यैतौ शिशू क्रीळन्तौ परि यातो अध्वरम् ।
विश्वान्यन्यो भुवनाभिचष्ट ऋतूँरन्यो विदधज्जायते पुनः ॥
RigVeda, 10/85/18)

**Transliteration:**

"*Poorvaparam charto maayayaitau shishoo kreelantau pari yaato adhvaram* ।

*Vishvaanyanyo bhuvanaabhichasht ritoomranyo vidadhajjaayate punah* ॥"

**Mantra Translation**

**"***Under the creation phenomenon, these two, the Sun and the Moon, move in* ***अध्वरम्*** (*adhvaram = space*) *like two children indulged in a play, one walking ahead or behind the other. One of them (Sun) reaches all created bhuvanani* (celestial objects) *and the other* (*Moon*) *representing seasons, renews itself repeatedly"*. (RigVeda, 10/85/18)

From the moment one opens one's eyes at birth the reality of coming into existence and the reality of the preexistence of substances in the surroundings begin to sink-in. With time, this reality slowly crosses the immediate surroundings to the outside environment where numerous other objects animate and inanimate, with differing shapes, sizes and colours become part of this reality. At some point in time this reality must have extended to include extraterrestrial objects: the Sun and the Moon. People may have even thought that the Sun and the Moon were bright objects

because there must be continuous fire burning in them. The Vedas in the mantras however said that the light reaching the Earth was due to the 'fire' in the Sun while the Moon was only a cool reflector of the Sun's light, that the same surface of the Moon faced the Earth and that there was the far-side to the Moon as well. The poetic adornment in the RigVeda mantra presented above delineates the difference between the Sun and the Moon.

Whereas the Vedic Cosmology Scenario developed in Chapter 7 to 9 sets up the steps leading to the Vedic Big Bang, the Chapter 10 deals with the process of dissolution of the universe. The last Chapter 11 deals with, in abridged form, the astronomy of the celestial objects created in the Vedic Big Bang. The Vedic astronomy is ancient yet rich in astronomic terminology and nomenclature. The Vedic *rishis*, in the form of mantra formulations, threaded the pearls of astronomy knowledge and extended it to the society for the benefit of all.

There is sufficient evidence in the mantras that the ancient *rishis* were seriously engaged in practical astronomy. Keeping brevity in mind the mantra references on astronomy, astronomical objects and their functioning are presented in this book with emphasis on the solar system and its specific objects. The reader will find that the Vedic astronomy, like the Vedic cosmology, is also on a high pedestal.

# Vedic Astronomy

Vedic astronomy has its roots in the four Vedas. The Vedic sages and scholar *acharyas* subsequently developed it further and wrote treatises on their work. There are a good number of such ancient treatises in the Sanskrit Literature on applied astronomy. The Western astronomers are most familiar with the ancient book of "Soorya Siddhant" (The Sun Principle) written in *shloka* poetry in the Sanskrit language. This book was referred to earlier, particularly in Chapter 5 when the categories of the Time-entity were defined. In addition to offering a rich Sanskrit astronomy nomenclature for astronomical bodies, along with definitions of astronomical phenomena and astronomical principles applied to practical astronomy, the book of "Soorya Siddhant" teaches how to calculate and predict, fairly accurately, the positions of the constellations and the objects of the solar system moving through the background of constellations. All this is achieved utilizing indigenous principles in trigonometry, celestial geometry and sophisticated mathematics that are un-influenced by the Western developments in mathematics and science.

The approach to the subject of astronomy in "Soorya Siddhant" itself points to the fact that the extremely rich Sanskrit terminology used in the book preexisted in the Vedas. The book is an indigenous creation of the Indian Aryans. A prey to the pre-conceived bias of the Western scholars, the age of this ancient book was erroneously assigned to be just a few centuries BCE. The guesswork on the historicity of "Soorya Siddhant" still continues. The fact remains that not just one but many *rishis* and *acharyas* in the far antiquity of India, have contributed to astronomy and left their work in the form of books generally known as *khagol samhitas*; *khagol* being the term for "*the science of astronomy*". With the exception of the "Soorya Siddhant" this author has not had the opportunity yet to read these ancient *samhitas* (treatises). To mention a few among a dozen listed in the Hindi translation and commentary on '*Soorya* Siddhant' by Mahaveer Prasad Srivastava (publ. Svaddyaya Sansthan, 1987) are: Taittireeya Samhita, Vriddhagargeeya Samhita, Narad Samhita, Nakshatra Kalp, Shakalya Brahm Siddhant and so on.

Astronomy in the West is considered to have started from the ancient Greeks who divided the northern sky based on constellations. They described the constellations and the planets in poems attaching specific myths to them. The earliest of these poems were by Hesiod in about the eighth century BCE. It was not until the second century CE when the Greek astronomer Ptolemy (90-168 CE) described the constellations in great detail, when the star mythology shifted to the science of observational astronomy. It has also been suggested that copying of material and the transfer of knowledge between the countries and civilizations have taken place through the ages; the subject of astronomy included. In astronomy, the position of a star on the celestial sphere (sky-dome) is important and is generally assigned by its longitude. The values of the polar longitude of some known stars in different constellations given in "Soorya Siddhant" have no relation to those given by Greek astronomers, Hipparchus (190-120 BCE), Ptolemy (90-168 CE) and other Western astronomers. This shows the independence of "Soorya Siddhant" from any exterior influence. The astronomical data and the related deductions in the mantras take one far into the past compared to the astronomical developments in the West that began around the beginning of the Common Era.

In Chapter 3 it was established that the Vedas and most of the Vedic references in this book are antecedent to the Milestone at February 18, 3102 BCE. As mentioned before, even this date is an outcome of the Vedic astronomy. There is considerable content of astronomy in the Vedas themselves including the names and descriptions of a large number of constellations covering the celestial sphere from the North to the South. A remarkable feature of the astronomy in the Veda is the nomenclature of 28 constellations of which 27 are listed in "Soorya Siddhant" and are also currently in use in Indiaan astronomy. Having the Vedic origin it is not surprising that these constellations continue to be recognized as such and observed in modern Indian astronomy in the same sequence as they are listed in the Veda. Based on the methodology of "Soorya Siddhant", the calculations of astronomical phenomena related to the positions of the Sun, the Moon and the Earth with respect to the well-defined constellations have a high degree of accuracy. That information has been used to generate accurate calendars that have been followed by the Vedic people through the ages. Many books and interpretive commentaries have been written on "Soorya Siddhant"'s virtues and its historical advent. These books are in

Sanskrit language written by Indian authors of the Sanskrit-period and some books are well-written in Hindi and English by authors of recent times. Several Western authors also have produced translations and have written commentaries on it. A few recent publications include the works of Udaya Narayan Singh (publ. Ramlal Kapoor Trust, 1986) and Mahaveer Prasad Sreevastava, mentioned above. There are other books on "Soorya Siddhant" referred to in these two books including some by Western authors. In this chapter alone several references from "Soorya Siddhant" are drawn on applied and observational astronomy with continued emphasis on Veda mantra references.

No science development in a society is possible without the simultaneous development of proper terminology to advance it. Just as the Vedas are the source of indigenous astronomy, the Vedas are also the source of the rich science terminology in the Sanskrit language. As in previous chapters the relevant and important Vedic terms in physics and astronomy will be defined and interpreted. Also as mentioned earlier, the mantra interpretation here is based on the *yaugik* meanings of the terms and the etymology is from the book of Nirukt by Rishi Yask.

# Common Astronomy Terms in the Mantras

## Samvatsar – Time-cycles:

The Vedas in compact mantra formulations have pointed out that the Time-entity has entrapped the objects of astronomy within the cycles of day and night, months, seasons and years. Considerable insight into the Vedic system of time-division was presented in Chapter 5 under the main sub-heading, '*Kaalah-Tatva*: the Time-Entity' The largest time-cycle discussed under Time-entity was the creation cycle named *kalpa-vikalpa* with the period of 8.64 Billion Years, half of which is the creation phase (*kalpa*). It was presented in Chapter 5 that the Aryans divided the time in both, the large scale harmonics within a *kalp* having four types of *yugas* and 14 *manvantars* as well as the small time-divisions from *samvatsar* (a year) down to a *nimesh* measuring 8/45$^{th}$ of a second. This author addresses them as harmonics because they occur repeatedly in a given order at their fixed frequencies.

The Vedic Aryans have studied and understood these time-cycles with respect to lunar phases, the Moon's position against the constellations during a lunar *maah* (month) and the Sun's position against the constellations during a *samvatsar*. After the turbulent early universe settled and entered the orderly phase, the solar system found itself trapped into a time cycle that brought repeatability and predictability for the humans on the Earth. The Veda gave this periodicity a meaningful name, the *samvatsar*. In Chapter 5 the difference between a *human-samvatsar* and *devic samvatsar* was also pointed out. It is important to note that whereas a *human-samvatsar* is one Earth year (or the solar year) a *devic-samvatsar* is 4.32 Million Years.

It was mentioned in Chapter 9 that there is periodicity within periodicity in Nature, beginning from inside an atom to a galaxy and the universe. All systems are bound in their own *samvatsars*. The *samvatsar* for the Earth is the solar-year. Since the Sun is the cause for *samvatsar* on the Earth, the Sun itself is also addressed as the *samvatsar*. To understand a system bound by time one needs to understand its *samvatsar*. The observation of cosmos in the framework of a *samvatsar* is astronomy. The Sanskrit terms for astronomy are *khagol-vidya* and *jyotish-shastra*.

***Dyu* – Abode of Sun**: The term *dyu* represents the brilliant space occupied by the Sun and the brilliant region surrounding the Sun. There are several variations of the term *dyu* such as *dyava* and *diva*.

***Rodasi* – Sun-Earth System**: The term *rodasi* in the Vedas represents a limited region of *Antariksh* (Space) in which the Sun-Earth system is confined. Because the brilliant region surrounding the Sun is termed as the *dyu*, the *dyu*-Earth system (or *dyava-**Prithvi*** system) is also addressed as the *rodasi*. Owing to a specific physical property of the region surrounding the Sun, some mantras have addressed the joint Sun-Earth system as *rodasi*, this specific physical property being its stability and self-sufficiency. This Vedic prescribed division of *Antariksh* (Space) is in the likeness of the division of the Earth's atmosphere in Troposphere (≈ 0 to 12 km altitude) wherein all weather phenomena occur and Stratosphere (12 to 50 km altitude) wherein resides the well talked-about Ozone-layer and so on. In comparison the *rodasi* is on a much larger expanse of the space.

The term *rodasi* is in dual-plural grammatical usage because it represents the physical system made up of two specific entities, the *dyava-Prithvi* (Sun-Earth). Rishi Yask (>1900 BCE) in his Nirukt *sutra*, the interpretive commentary and analytical etymology of Vedic terms, presents an interpretation of the *Indra-Rodasi* system, mentioned in several RigVeda mantras, where the *Indra* in this context is the Sun. Rishi Yask takes up some of these Veda mantras and provides the interpretation of the individual terms of the mantra as well as the composite meaning of the mantra. The abridged form of the relevant Nirukt (6/1/2) *sutra* is:-

"*Machida-**Indra** **rodasi**[1] rodhasi dyava-Prithivayau **virodhnaat**[2]…….apaare doorpaare ….. kashiste mahaan*". The full translation of the *sutra* with several important terms emboldened is:

> *"O **Indra** (Sun), you even keep gathered together the **rodasi** of great expanse formed of dyava and **Prithvi**. O **maghvan** Indra, yours is an amazing fist* (as in fisting of the reins of horses). *The term rodasi is derived from **virodhan**[2] because the system of **dyava-Prithivi** holds together all diverse things*

*within it and opposes things leaving it like the banks of a river hold water from spilling over*". (Nirukt, 6/1/2).

Not only is the simile between the solar system (*rodasi*) and the banks of a river holding the water from escaping remarkable for the clarity of thought in defining *rodasi* as the ***Indra-Prithvi*** (Sun - Earth) system, but the simile also indicates a science perspective. The Vedic *rishis* give meaningful ***rodasi*** name to the vast Sun-Earth system as a closed system, not letting its contents escape, which is a scientific reality for the solar system.

Whereas the term *Indra* is a synonym for the Sun, the adjective ***maghvan*** for the Sun comes from the noun *maghah* which stands for a 'regional division'. The Sun is addressed as ***maghvan*** because it forms, rules and controls an independent region of space named *rodasi*. Even though the Sun is one of the 400 billion stars forming the Milky Way Galaxy, the *rodasi* region around the Sun is a self-sustained region. The property of *rodasi*, not to let its objects leave it, is certainly not based on imagination. It is a splendid deduction derived out of the observation of the region. The definition of *rodasi* must have been a result of practical astronomy.

The fact that the Sun and not the Earth is indicated to be the governing entity (metaphoric expression - reins of force in its fist) of the *rodasi*, by itself is a remarkable piece of science from the far antiquity. The Sun is popularly known for its radiation but the RigVeda mantras on the Sun and the *rodasi*, the subject of Rishi Yask's interpretation in his Nirukt *sutra* (6/1/2), talks instead about the force of attraction. The force of attraction according to the mantras is exerted by the Sun with complete control on the *dyu*-Earth system. One would think that between the gigantic Earth as observed by the humans and the apparently insignificant solar disc far away in the sky, also observed by the humans, the Veda would make it Earth-centric to hold the Sun-Earth system together. Instead the Veda unequivocally credits the Sun for holding the ***rodasi*** together with the controlling forces, as the horses of a chariot are controlled by the reins held in a tight fist. This is an ancient lesson in physics and astronomy, together.

# Recognition of Scholarship

## *Addhaataya, Kaal-vid, Maatli, Angiras, Vishva-vid*

Just as the present societies bestow high respect on intellectuals and assign designations to the specialists in their areas such as physicist, chemist, astronomer and so on, it is obvious from numerous mantras that the Vedas have high admiration for learned people. In addition to the general designations such as *rishi, muni* and *acharya* for sages and deep thinkers, there are specific terms for experts in their subjects. In the literature of a society, the titles and honors are bestowed on the scholarly in specialized subject areas only when considerable development in those areas has already taken place in the society.

As in the RigVeda mantra (10/85/16), the Vedic term for a person with enhanced intellect who understands the science of Time and *samvatsar* is praised highly and addressed as an *addhaataya,* which translates into-

*The two cycles related to the Sun that correlate with the seasons are well understood by scholarly brahamans but the third cycle termed as the samvatsar is only understood by an addhaataya*. (RigVeda, 10/85/16)

This author mentioned earlier the two different *samvatsar*s, one of humans and the other of '*devas*'. There are about 60 different samvatsars in the Vedic Literature. Five out of these 60 mentioned in one mantra of YajurVeda (30/15) are- *samvatsar, parivatsar, idaavatsar, anuvatsar* and *idvatsar* that relate to the long-term time-cycles in Nature. As in the mantra, the "intellectual older women" are said to be knowledgeable of these five time-cycles who apply their knowledge of time to the family and the society. Such scholarly women with long experience of life and knowledge of the fourth *anuvatsar* time-cycle are addressed in this YajurVeda mantra as "*ribhubhya vijarjaraam-palikneem*", which means "*the intellectual lady in advanced age with white hair*". The Vedas express very high respect for a scholarly female, particularly for an older, wise female who is able to apply the knowledge of time.

Manu in his book of Manusmriti presents a series of shlokas on time-scales. One shloka states:

> *"Those who understand one thousand yuga* (one thousand *maha-yuga*) *the long pious day of the Brahmn (the Creator) and the night of the same duration, are the* ***kaal-vid****, who understand the science of time and are true scholars of creation and dissolution."*. (Manusmriti, 1/73).

Thus, a term for the scholar of Time-science is *kaal-vid*. It is learnt from the other references in the Vedic literature that the term for a *rishi* having deep knowledge of Space and *rodasi*, latter being a specific confined region of the former, is addressed as a *maatli* and one with experimental knowledge of energy is an *angiras*. A scholar of the universe in modern terminology is a cosmologist. The Vedic term for a cosmologist, as in AtharvaVeda mantra (9/9/10) is the *vishva-vid*, where the term '*vishva*' means the 'universe' and '*vid*' means the 'person with the knowledge of'.

The modern *addhaataya*, *kaal-vid*, *maatli, angiras* and *vishva-vid* are the accomplished scientists in their respective areas. Therefore, it could be deduced that if there is recognition and praise for the scholarly in the Vedas with such enriched specific titles, the Vedas must have in them the mantras dealing with science pertaining to time-science, space-science and energy-science.

The aim of this chapter is to show that there is considerable astronomy in the Vedas. One finds abundance of science thoughts in the Vedas that are common with contemporary physics and astronomy. Additionally, there are some thoughts that are unique to the Vedas which are credited to some *addhaatayas* and *kaal-vids* who are named as the authors of specific *suktas* (Vedic hymns) of the Vedas.

Compared to the extensive research and development in modern astronomy over the past couple of centuries by modern *addhaatayas*, even if the contribution of the Vedic *addhaatayas* is deemed insignificant, it certainly would stand to claim its undeniable seniority. The following pages will show that exceptionally brilliant people were born in the Vedic society eons ago who contributed to astronomy in their unique way. At times they drew deductions that are substantive yet mysterious. Those who think that a science thought in the Vedas is no big deal, should certainly admire the invention of rich science terminology in the Sanskrit language applied to observational astronomy. The richness of meaningful terminology in mathematics and science is the indicator of the development in these subjects in the society.

This chapter includes several aspects of Vedic astronomy that will include the names of 28 *nakshatras* (constellations) named by the Veda and also presents the principle of creation of the solar system, the physical properties of the Sun and the planets, with special emphasis on the Earth and the Moon.

## Vedic Nakshatras: the Constellations

Before discussing the Vedic aspects of astronomy let us first review briefly our present understanding of the solar system and the constellations. The modern observational astronomy has progressed in leaps and bounds achieving highest resolution in telescopes that enable the detection of exo-planets orbiting in other solar

systems and the mapping of the entire sky in all directions, revealing the presence of stars previously not seen in our galaxy and altogether new galaxies right up to the periphery of the observable universe. Our Sun with its planetary system is situated on the inner rim of our galaxy's Orion Arm, represented by the letter S in Figure 9.6 in Chapter 9.

The solar system is surrounded by a multitude of stars in all directions that are perceived to be on an imaginary sphere surrounding the Earth. Those who have visited a planetarium would remember that a part of such a sphere is projected on a manmade spherical dome with stars and planets positioned accurately for a given day and time. In the night sky when it is dark and clear, one observes stars from horizon to horizon in all directions as if they are projected on a dome, however, this dome is not tangible like the dome in a planetarium. The dome surrounding the Earth is called the celestial sphere. Earth's daily rotation from west to east makes the observer see a swath on this dome with stars moving from east to west such that they are seen setting in the west and the successive stars rising in the east. To see all the stars of the celestial sphere the observer has to change positions covering the Earth from the north-pole to the south-pole.

Just as the spherical Earth is divided into two hemispheres on either side of the equator the celestial sphere is also divided by its equator called the celestial equator. Just as the geographic position of a place on the Earth is defined by its latitude-longitude coordinates, the position of a star on the celestial sphere is defined by the star's celestial latitude-longitude coordinates. Just as the north-most point on the Earth is named the North Pole and the south-most point is named the South Pole, the celestial sphere also has its North and South poles.

The star positions with respect to each other do not change night after night. Therefore one could divide the observable sky into groups of stars or in equal divisions of a circle over the observer. Historically who first attempted to divide the sky into how many sectors, is difficult to pinpoint, however, what we have in practice today is what the international body of astronomers, the International Astronomical Union, has decided. According to this union the whole area of the sky including all stars on the celestial sphere are divided into 88 constellations with their defined boundaries. In a given area of the celestial sphere several stars together form some geometric patterns that can be recognized with the specific shapes and forms that we are familiar with. Such predetermined and named shapes formed by the stars, are internationally accepted by astronomers. Such a group of stars is known as a constellation. The names of 48 out of the 88 constellations are the same as described by the Greek astronomer Ptolemy in the second century CE. The ancient Chinese have named their own constellations that are not common with those in the Western astronomy.

The middle swath of the celestial sphere through the middle of which runs the celestial equator is known as the "zodiac". The Sun's apparent path called the "ecliptic" is not parallel to the celestial equator; rather it is tilted showing the Sun

above it for half the year and below it for the other half. Just as the daily rotation of the Earth with the tilt in its axis makes the Sun appear to be moving from the northern hemisphere to the southern hemisphere and back, the Earth's revolution around the Sun makes the Sun to appear in the changing background of the stars on the celestial sphere. As the Earth moves in space around the Sun the Sun is seen moving from one constellation to the next. We in fact do not see the stars when the Sun is up but we know that the Sun is in a constellation that is exactly opposite to the constellation seen overhead at exact midnight.

The whole 360° circle of the zodiac is presently divided into 27 constellations of 13º:20' (degrees: minutes) each. Just as an hour is divided into 60 minutes, an arc of one degree (1°) on a circle is divided into sixty minutes (60'). Therefore, 13º: 20' arc in degrees is 13.33°. The circle of the zodiac is also divided into 12 equal sectors of 30º each called the zodiac signs. As the Earth moves in space around the Sun through 30º, which corresponds to the duration of about a month, the Sun is seen entering into a zodiac sign and exiting from it in about a month.

We all wonder about the stars, however, the question is whether the Vedic *rishis* wondered about them from an astronomical perspective? Did they pursue astronomical observations of the night-sky and try to group stars in a way now recognized in the Western astronomy? Does their contribution relate even remotely to the present day astronomy? The answer to all these questions is yes. The evidence of this 'yes' in the mantras is overwhelming. Any mantra reference to astronomy is the foundation stone of astronomy in the ancient Vedic civilization, a foundation stone on which to build further. The fact is that there are many constellations mentioned in the four Vedas. The AtharvaVeda, within the same *sukta*, has provided Sanskrit nomenclature for 28 successive constellations of the zodiac, covering the full zodiac. The same constellations correspond to 27 constellations that the Greeks named in the Greek language eons after the AtharvaVeda named them in Sanskrit; many having the same meaning as well. The Greek-named constellations are in practice in the modern astronomy. The AtharvaVeda-named constellations are also presently in practice in indigenous astronomy followed by the Indian scholars and pundits. Before invoking the AtharvaVeda *sukta* on constellations let us look at the related question-answer in a RigVeda mantra. The answer to the question as to whether the Vedic sages wondered about the stars is contained in the poetry of the mantra in the RigVeda (1/24/10).

अमी य ऋक्षा निहितास उच्चा नक्तं ददृश्रे कुह चिद्दिवेयुः ।
अदब्धानि वरुणस्य व्रतानि विचाकशच्चन्द्रमा नक्तमेति ॥

RigVeda (1/24/10).

**Transliteration**:

"*Amee ya rikshaa nihitaas uchchaa naktam dadrishre kuha chiddiveyuh* ।
*Adabdhaani varunasya vrataani vichaakashachchandramaa naktmeti* ॥"

**Mantra Translation**:

> *"We ask who has placed the visible and invisible ऋक्षा (rikshaa), the nakshatras (stars) high up, confined on their own assigned paths (orbits)? Why are they visible at night and where do they go during the day? They remain in space yet are not seen under Varun's (Sun's) non-violent act of illumination (in the day) but are well lit at night even when the Moon is also seen"*. RigVeda (1/24/10).

That this mantra is the most ancient epitome of observational astronomy is the best description this author would bestow on it. The first part of the mantra raises the questions in astronomy and the second part provides the answers using the astronomy-based terminology. In addition to *Indra, Soorya, Maghvan* and many more synonyms for the Sun, the term *Varun* in this mantra is also a synonym for the Sun. The analysis of the term *varun* with the other two synonyms of the Sun, *Aditi-putra* and *Aaditya*, is presented in the ancient book of Nirukt (2/4/1) by Yask Rishi where he states that the Sun is named *Varun* because: (a) the Sun is *Aditi-putra* (*Aditi*'s son) for '*it is born of Aditi* (Nature)' and (b) the Sun is *Aaditya* for '*it takes away the illumination of the constellations*'. The Sun is also Varun because it creates and controls the ocean-atmosphere system on the Earth. This mantra's '*non-violent act of illumination'* of the Sun in the daylight means that it temporarily faints away the stars but does not destroy their illumination; an absolute fact deduced in Vedic astronomy. This, with the meaning of the term *rikshaa* being '*non-decaying celestial objects in the sky*', the inquiry in the mantra is regarding the stars. That they remain '*confined on their own assigned paths'* is a deduction resulting from long-term astronomical observations. The Vedas in fact go well beyond this remarkable observation of the invariant orbits of the stars. They group the stars into constellations giving them specific names as presented in what follows shortly.

The most used term for stars in Vedic astronomy, synonymous to the term *rikshaa*, is *nakshatra*. The root and conjugation of the words forming the term *nakshatra* yield the meaning - '*one which does not decay or diminish with time*'. It continues to be the most common term in Vedic astronomy and has descended into the vocabulary of common people of the Indian civilization. While *taara* is the most common term for a single star, the term *nakshatra* is mostly for a well-defined and named specific group of close-by stars in a limited area of the celestial dome. A *nakshatra* in the Vedic astronomy is mostly a multi-star geometric formation; however, it can be a single star also. Whether it is a single-star *nakshatra* or a multi-star *nakshatra*, it is identified by a specific name given to it in the Vedas and the same

name continues in Indian astronomy till this day. The identification of a section of the night-sky with such a Vedic nomenclature is similar to the identification of the night-sky by a modern astronomer using the names of certain constellations. The observed property of a star and a group of stars in a *nakshatra* is that they do not change night after night in their brightness and in their geometric pattern. It is this feature of a *nakshatra* that gives it the adjectival descriptive name of *nakshatra*.

The very first mention of the three *nakshatras*, Revati, Punarvasus and Pushya occurs in RigVeda mantras (10/19/1, 3). The important feature of these two mantras of the 19$^{th}$ *sukta* in RigVeda's 10$^{th}$ chapter is that they provide an ensemble of several terms of astronomy which relate to the properties of *nakshatras* which are utilized even now in practical astronomy in India. These terms are: *punah* which means 'again' or 'repeatedly', because the *nakshatras* repeat their occurrence, *ayan* meaning a defined closed circular path on the celestial sphere that a celestial body completes in its periodic motion, *aavartan* means a cyclic repetition, *nivartan* means to come back again to the same point and so on. All these terms point to the cyclic nature of the constellations, coming back again and again, unwavering on their path. There is a spiritual component also in these mantras. It is the prayer of invocation to the Creator of all the *nakshatras* for the continuance of the *nakshatras* in their undisturbed cyclical journey. Implicit in the prayer is that a failure in continuity of constellations is the end of creation. The prayer invocation also relates to their timely occurrence at the onset of a specific period in the social life of humans, bringing prosperity and well-being.

A reference to the Revati constellation is also made in YajurVeda (1/19). The meaning of the term *revati* is two-fold: *pure flowing water* and *one that is associated with sweet medicinal herbs*. This constellation is in the shape of a moving fish with 32 stars in its formation. The RigVeda mantra (1/103/2) under the *Indra* (Sun) *sukta* makes a mention of '*the Sun breaking up the strong rising cloud-formations to create rain on Earth during the Rohini constellation'*, the Rohini constellation being the second in the sequence of the 28 Veda-named constellations. The AtharvaVeda then extended the nomenclature preparing the composite list of the *nakshatras*. This author feels that the division of the same zodiac into 28 constellations in the AtharvaVeda rather than the count of 27 in the present day astronomy had a physics reason. This will be discussed in the following.

The Vedas have clear indication of numerous other constellations ascribed to the northern sky which is the *daivic*-hemisphere of the Vedas. Beyond the 28 *nakshatras* in the bend of the zodiac are named other *nakshatras* right up to the *Uttar-sumeru* (North Pole) where the prominent constellation of *Sapt-rishi* (*Seven-rishis*) is addressed with the name *riksh* in the RigVeda (1/24/10). The root meaning of a word expresses the property of the entity. As mentioned above the root meaning of the term *rikshah* is *nakshatra*, however, there is a common meaning of the word *riksh* that means '*a bear*'. It is interesting that the name of this Sapt-rishi constellation, in the Western astronomy, is the 'Great Bear'. There is certainly an element of surprise as to

how the same meaning of 'a bear' ended up in modern astronomy. A large number of constellations are also named in the Vedas from the *asura-hemishere* (southern hemisphere) right down to the *Dakshin-sumeru* (South Pole). These *nakshatras* add up to thousands of stars in them. This author has benefitted from the research on *nakshatras* included in an interpretive book on *"Soorya Siddhant"* by Udaya Narayan Singh, cited earlier.

The astronomer *rishis* from ancient times have been observing the constellations and preparing lunar calendars to keep track of time, dates of festivals, celebrations, special worship days, the onset dates for sowing of seeds by the farmers and for many other activities in the society. Not counting the deductions from the Indian astronomical observatories just before and after the Common Era began, there are a number of astronomical deductions found in the ancient book of Mahabharata that were discussed in Chapter 3 with reference to Rishi Vedvyas making astronomical observations 'night-after-night' from the bank of the River Sarasvati. Rishi Vedvyas's observations related to a period of about 40 years prior to the Milestone at February 18, 3102 BCE established in Chapter 3. The AtharvaVeda nomenclature of 28 *nakshatras* in its 19th chapter preceded Mahabharata. This makes the Vedic nomenclature of *nakshatras* the earliest among the ancient civilizations.

The nomenclature of constellations in the AtharvaVeda is in its 7th *sukta* of the 19th chapter. The *devata* (subject) assigned to this *sukta* is "*Nakshatrani Devatah*", expressing plurality of *nakshatra*, which in fact is the case. Of the five mantras in this *sukta* the first mantra is devoted to the invocation prayer for the recitation of the names and properties of the *nakshatras* and the last four mantras sequentially list the actual names of the 28 *nakshatras*. For the sake of brevity only the direct translations of the mantras, without the detailed word for word translation, are presented here. A *nakshatra* being a unit with a number of stars in it, the names appear pluralized in dual-plural or general-plural, depending on the number of stars contained in their geometric formation. In the mantra translations below, this author has superscripted the serial number of the *nakshatra* and capitalized the first letter in the *nakshatra's* name. These names are serially listed in Table 11.1 in singular expression with their corresponding Greek (Latin) names. The reader would notice that surprisingly, the Greek (Latin) nomenclature of 27 constellations is in the same serial order as in the AtharvaVeda.

चित्राणि साकं दिवि रोचनानि सरिसृपाणि भुवने जवानि ।
तुर्मिशं सुमतिमिच्छमानो अहानि गीर्भि: सपर्यामि नाकम ॥

(AtharvaVeda**,** 19/7/1)

**Transliteration:**

"*Chitraani saakam divi rochanaani sarisripaani bhuvane javaani* ।

*Turmisham sumatimichchhamaano ahaani geerbhih saparyaami naakam* ॥"

**Mantra Translation:**

*"In the illuminated space of this creation are the wonderful nakshatras, luminous and fast-moving with sliding motion in togetherness. Desirous of meditation in the dynamic mind and the clarity in my intellect, I worship the bliss-bestower Creator all days uttering the Veda mantras"* (AtharvaVeda, 19/7/1).

सुहवमग्ने कृत्तिका[1] रोहिणि[2] चास्तु भद्रं मृगशिर: [3] शमार्द्रा[4] ।
पुनर्वसू[5] सूनृता चारु पुष्यो[6] भानुराश्लेषा[7] अयनं मघा[8] मे ॥

(AtharvaVeda**,** 19/7/2)

**Transliteration:**

**"***Suhavamagne Krittikaa[1] Rohini[2] chaastu bhadram Mrigshirah[3] sham-Ardra[4] ।*
*Punarvasu[5] soonrita chaaru Pushyo[6] bhaanuh-Ashlesha[7] ayanam Magha [8] mey ॥"*

**Mantra Translation:**

***"O Omnipresent! Let the Krittikas[1] and Rohini[2] be happiness-evoking. Let the Mrigshirah[3] bring wellbeing and the Ardra[4] peace. Let both Punarvasus[5] and bright Pushya[6] be favourable in all good resolves. Let Ashleshas[7] and Maghas[8] bring enlightenment and provide direction for the right path."*** **(AtharvaVeda, 19/7/2)**

**पुण्यं पूर्वा फल्गुन्यौ[9,10] चात्र हस्त[11]श्चित्रा[12] शिवा स्वाति[13] सुखो मे अस्तु ।**
**धे विशाखे[14] सुहवानुराधा[15] ज्येष्ठा[16] सुनक्षत्रमरिष्ट मूलम्[17] ॥**

(AtharvaVeda**,** 19/7/3)

**Transliteration:**

"*Punyam poorva Phalgunyau[9,10] chaatra Hasth[11] Chitra[12] shiva Svaati[13] sukho mey astu ।*
*Raadhe Vishaakhe[14]suhavaa-Anuraadha[15] Jyeshttha[16]sunakshatramarishta Moolam[17] ॥"*

**Mantra Translation:**

*"Both the antecedent and the subsequent Phalgunis*[9, 10] *with purity, Hastah*[11] *the happiness provider and Chitra*[12] *and Svati*[13] *bring bliss for me. O raadha Vishakha*[14] *of prosperity you are being invoked with happiness. Let Anuraadha*[15] *and Jyeshtha*[16] *be invoked with happiness and the beautiful Mool*[17] *nakshatra bring harmlessness"* (AtharvaVeda, 19/7/3).

अन्नं पूर्वा रासतां मे अषाढा[18,19] उर्जं देव्युत्तरा आ वहन्तु ।
अभिजिन्मे[20]रासतां पुण्यमेव श्रवण:[21]श्रविष्ठा[22]कुर्वतां सुपुष्टिम् ॥ (AtharaVeda, 19/7/4)

**Transliteration:**

"*Annam poorva raastaam mey Ashaadha*[18,19] *urjam devyuttara aa vahantu* ।
*Abhijinme*[20] *raastaam punyamev Shravanah*[21] *Shravishttha*[22] *kurvataam supushtim* ॥"

**Mantra Translation:**

*"Let the Poorva-Ashaadha*[18] *bring prosperity to me with food and the bright Uttara-Ashaadha*[19] *bring me valor, Abhijit*[20] *leads me to only the benevolent acts and Shravana*[21] *and Shravishtha*[22] *bring immense strength."* (AtharvaVeda, 19/7/4)

आ मे महच्छतभिषग्[23] वरीय आ मे द्वया प्रोष्ठपदा[24,25] सुशर्म ।
आ रेवती[26] चाश्वयुजौ[27] भगं म आ मे रयिं भरण्य[28] आ वहंतु ॥

(AtharvaVeda, 19/7/5)

**Transliteration:**

"*Aa mey mahachchhatbhishag*[23] *vareeya aa mey dvayaa Proshtthapada*[24, 25] *susharm* ।
*Aa Revati*[26] *cha-Ashvayujau*[27] *bhagam ma aa mey rayim Bharanya*[22] *aa vahantu* ॥"

**Mantra Translation:**

*"Let the wide Shatbhishaj*[23] *bring extended prosperity for me, the Proshthapadaa*[24,25] *twins (first-Proshtpada and second-Proshtpada) bring me great happiness, Revati*[26] *like a moving fish and Ashvayuj*[27]

*like two horse riders bring great prosperity for me, and Bharanya*[28] *bring me wealth."* (AtharvaVeda, 19/7/5)

The subject of *nakshatra* is invoked in the first mantra giving a few common features of the constellations and a prayer is offered for the concentration of the mind and the enhancement of the intellect to understand well the creation and its illuminated heavenly bodies. The 28 successive Vedic constellations are presented in the next four mantras. With some knowledge of the root-based terminology in Sanskrit the meaning of all 28 names of the constellations becomes obvious when they are read and pronounced. Each of these 28 constellations yields a meaning that gives a quick description of the geometry of the star formation within a constellation. In the Table 11.1 are listed these meanings against the name of each *nakshatra*.

Two more mantras from the next *sukta* (8th *sukta* of Chapter 19 of AtharvaVeda) are included which also relate to the subject of *nakshatra*. So that there is no discrepancy in counting the number of *nakshatras* listed in the mantras of the previous *sukta,* the second mantra of the 8th *sukta* states with clarity that the Vedic *nakshatras* are exactly 28 in number. While invoking the prayer for wellbeing in all aspects of living, the AtharvaVeda mantra (19/8/2) provides the count of अष्टाविंशानि (*ashta-vinshaani*), meaning 'twenty-eight'. Thus the AtharvaVeda leaves no doubt about the exact count of the constellations. The important feature of the Vedic nomenclature is that by the time one carefully identifies the geometric pattern of the first constellation contained in the meaning of its name and moves forward successively identifying the rest on the celestial dome, one ends up covering 360° on an arc which is a circle. Admittedly it is not an easy exercise to identify the constellations from scratch; however, an observational consensus certainly would yield the desired result. For example the 6-star constellation Krittika which is the 'η Tauri Alcyone' in the Greek terminology could be easier to identify. The term *krittika* means '*piercing*' or the stars forming a '*fire-flame shape'*. The other example is the term *shatbhishaj* for the 23rd constellation. Shatbhishaj (λ Aquarii) means '*one in round shape with 100 stars*'. The term *revati* for the 26th constellation Revati (ζ Piscium) means 'moving like fish, or '*fish-shaped*'. A large number of stars in Revati totaling 32 are also easy to identify. This astronomical division of the sky is a remarkable achievement by the Vedic *rishis*.

The Table 11.1 is kept simple without too many details on the constellations which otherwise are available in the book of "Soorya Siddhant". The number of stars in each constellation is also taken from the book of "Soorya Siddhant". The "Soorya Siddhant" *shlokas* narrate the coordinates of the *yog-tara* (assigned primary star of a constellation) of each constellation in degrees and minutes of an arc even giving the measure of the north-side or the south-side shift with respect to the ecliptic (Sun's path in the zodiac). Included in the table is also the Vedic name of the month and its relationship to the constellation. Unlike in other civilizations where the 12 months of

the year have been named with little correlation to the corresponding constellations, a month in the Vedic system is named based on the onset of the constellation (or its synonym) during that period. The solar year of the Vedic calendar is divided into twelve months and the months are tracked by the lunar phases such that the full-Moon day is the completion of a lunar month. Thus the name of a luni-solar month is the name of the constellation wherein the Moon is on its full-Moon day. This feature of Vedic astronomy where the Moon's association with a constellation yields the name of the month is a remarkable feature of observational astronomy and is a unique astronomical practice in the world. The Indian system of nomenclature of the months also reveals the position of the Earth in its orbit. This makes the Vedic astronomy an indigenous development, free from any external influence.

Notice in the table that the first constellation is Krittika, its month Kartik is $8^{th}$ in the Indian calendar. Without going into the details, it should suffice here that the beginning of the Hindu year is synchronized with the spring-equinox which presently is in the month of March which in the Hindu calendar is the month of Chaitra named after the constellation Chitra ($12^{th}$ in table). It is known that owing to the long-term slow wobble of the Earth's axis, the equinox point keeps shifting and therefore with certainty, at one point in time, the equinox occurred in Krittika, the first constellation. A bit more discussion on it will follow.

## Short Discussion on Table 11.1

The "Soorya Siddhant" and all other books in the Vedic Literature have the same constellation names in the same order as in AtharvaVeda except that they all now have 27 constellations. In its $8^{th}$ chapter the book of "Soorya Siddhant" mentions the Abhijit ($20^{th}$) constellation but merges it into Uttara-Aashaadha ($19^{th}$), listing a total of 27 constellations. It provides the method for calculating their angular swath defining their individual angular span on the ecliptic (Sun's path through the constellations). Since all constellations are on a circular swath without a beginning, there is no specific starting constellation.

| **Table 11.1:** The 28 Vedic Constellations and their corresponding |
|---|

| English / Greek names | | | | | |
|---|---|---|---|---|---|
| **S. No.** | **Vedic Nakshatras** | **Word meaning and geometry** | **No. of Stars** | **Greek (Latin) Name** | **Vedic Months and Month's Number** |
| 1 | Krittika | piercing, fire-flame shaped | 6 | η Tauri Alcyone | Kaartik (8) |
| 2 | Rohini | Health-creating, bright-featured | 5 | α Tauri Aldeboran | |
| 3 | Mrigshira | deer-head shape | 3 | λ Orionis | Agrahan (9) |
| 4 | Ardra | wet, bright lotus-shaped | 1 | α Orionis | |
| 5 | Punarvasu | pluralized for two, bow-shaped | 5 | β Geminorum Pollux | |
| 6 | Pushya | Provider | 1 | δ Cancri | Pushya (10) |
| 7 | Ashlesha | in togetherness, circular-shape | 6 | α Cancri Hydrae | |
| 8 | Magha | worshipped, plough-shaped | 5 | α Leonis Regulus | Magha (11) |
| 9 | Purv-Phaalguni | fruit-producing, cot-shaped | 2 | δ Leonis | |
| 10 | Uttar-phaalguni | fruit-producing, cot-shaped | 2 | β Leonis Denebola | Falgun (12) |
| 11 | Hasta | hand-shaped | 5 | δ Corvi | |
| 12 | Chitra | amazing, | 1 | α Virgenis | Chaitra (1) |

| | | | | | |
|---|---|---|---|---|---|
| | | white like a pearl | | Spica | |
| 13 | Svaati | moving alone, red-colored | 1 | α Bootis Arcturus | |
| 14 | Vishaakha (Raadha) | with branches, entrance-door shape | 4 | α Librae | Vaishakh (2) |
| 15 | Anuraadha | follower of Radha snake-shaped | 7 | δ Scorpionis | |
| 16 | Jeshtha | biggest, boar-tusk | 3 | Antares | Jyeshta (3) |
| 17 | Moolam | like root, lion-tail shape | 9 | ε, ζ, η, θ, ι, κ, λ, υ, μ and ν Scorpii | |
| 18 | Poorv-Aashaadha | first Ashaadha, chaff cleaner shape | 4 | δ Saggitaii | Aashaadha (4) |
| 19 | Uttar-Aashaadha | second Ashaadha, chaff cleaner shape | 4 | τ Saggitaii | |
| 20 | Abhijit | victorious from all directions, triangle-shaped | 3 | Aega | |
| 21 | Shravana | listener, arrow-shaped | 3 | α Aquilate Altair | Shravana (5) |
| 22 | Shravishtha or Dhanishtha | famous, musical drum-shaped | 5 | α Delphini | |

| | | | | | |
|---|---|---|---|---|---|
| 23 | Shatbhishaj | With one hundred stars, round shape | 100 | λ Aquarii | |
| 24 | Poorva Bhadrapada (Poorva Proshtpada) | one with feet like a cow | 2 | α Pegasi Markab | Bhadrapada (6) |
| 25 | Uttara Bhadrapada (Uttara Proshtpada) | one with feet of a cow | 8 | α Andromedae Pegasi | |
| 26 | Revati | moving like fish, fish-shaped | 32 | ζ Piscium | Kumaar (7) |
| 27 | Ashvini or Ashvayujau | pluralized in two, horse rider shape | 3 | α Arietis | |
| 28 | Bharani | provider, triangular | 3 | μ Arietis | |

The AtharvaVeda's first constellation is Krittika, however, for some astronomy reason the first in the book of "Soorya Siddhant" is Ashvini; Krittika being 3rd in the sequence. The most obvious reason for this shift is the *ayan-chalan,* a term in Vedic astronomy the equivalent of which in Western astronomy is the 'Precession of Equinox'. This means that the equinox point keeps shifting westward owing to the long-term slow wobble of the Earth's axis. One complete wobble (precession) of Earth's axis completing a circle means that the apparent position of the Sun at equinox would have moved westward through 360º covering all constellations on the celestial equator. One complete precession of Earth's axis takes about 25,920 years.

When the zodiac system was developed in Babylonia, around 2,500 years ago, the precession of the equinoxes was not known. In the Western astronomy, it was first discovered by the Greek astronomer Hipparchus (90- 120 BCE) when he found that the star coordinates listed some centuries earlier had shifted. However, Ptolemy (90–168 CE), another Greek astronomer, did not catch on to it and used the tropical coordinate system instead, which primarily is fixed to the Earth's seasonal cycle and not to a star in a constellation. One of the stalwarts in Hindu mathematics and astronomy, Bhaskar-II (1114–1185 CE), who was the head of the Astronomy Observatory at Ujjain in the central Indian state of Maddhya Pradesh, furnished in his treatise entitled 'Siddhant Shiromani' the equations for the measurement of the Precession of the Equinoxes. Scholars of Hindu astronomy quote him stating from his

book that his equations are based on some lost equations of "Soorya Siddhant". There is no indication that his formulations and those in "Soorya Siddhant" were influenced by the Greek astronomers.

The Vedic creation calendar is considered to have its beginning in the constellation of Krittika the first constellation in the list of AtharvaVeda. The first constellation in the book of "Soorya Siddhant" is Ashvini, two constellations behind Krittika. Also the Vedic *samvatsar* (year) begins on the Spring Equinox, which in 2018 according to the Vedic calendar was in the month of Chaitra on March 18. The constellation Chitra is 12$^{th}$ in AtharvaVeda. Therefore, if the shift in constellations between Krittika and Chitra is due to the west-ward "Precession of Equinox" (*Ayan Chalan* in Vedic astronomy), about 18 constellations have elapsed between Krittika and Chitra. A complete precision of equinox completing 360$^{o}$ coverin all 28 constellations being equivalent to 25,920 years, the 18 out of 28 constellations corresponds to 16,663 years. This indicates that there is considerable room for further research to resove these astronomic differences.

The fact is that the AtharvaVeda is an extremely old book put together in the far antiquity long before Mahabharata which is 38 years prior to the astronomy date of 18$^{th}$ February 3102 BCE, which is the onset of the Kali-Yuga Calendar of the Aryans. All these developments in Vedic astronomy took place beyond five millennia in the past, well before the astronomical development in the West. The notable point here is that if not 28, the astronomers in the world of Hipparchus (190-120 BCE) and Ptolemy (90-168 CE) around 2000 years ago settled for 27 constellations, not 20, nor 360. Therefore an interesting deduction here is that the origin of counting the constellations and assigning descriptive nomenclature to them could have come from the AtharvaVeda.

This author feels that the AtharvaVeda dividing the celestial equator into 28 *nakshatras* (constellations) rather than 27 has a scientific reason and it relates to the usefulness of the Moon in counting the days of the month. The indication of this is in the first mantra of the very next *sukta* of AtharvaVeda (19/8/1):

*"Of the nakshatras residing in the* दिव्य अन्तरिक्षे *(divya-antarikshe) the illuminated space, those above the water surface, those above ground and those above the mountain regions in all directions are successively scaled* (प्रकल्पयन् = *prakalpayan*) *by the traversing Moon. Let all these nakshatras bring peace and prosperity to me."* AtharvaVeda (19/8/1).

This mantra stating that the Moon scales the constellations and another RigVeda mantra instructing to use the Moon for counting the days in the month may have led to dividing the celestial equator into 28 parts to relate them to the synodic-month (new moon to new moon) of the Moon which is also known as the 'lunar-month' of 29.53 days.

Mysteriously the Vedas have 360 day-year rather than the current 365 days. Sometime in the antiquity of the Earth, the length of its year being 360 days cannot be completely discounted. There is a fair bit of discussion in the open literature on the subject of the Earth-year being 360 days versus 365 days. Other ancient civilizations have also used the 360 day-year. Several factors are attributed to lengthening of the Earth-year to 365 days; the increase in the speed of the Earth around the Sun, the change in the size of the Earth and so on. Some references indicate that 360 day-year prevailed in the Western civilizations till about the 8th century BCE. With a possibility of 360 day-year the origin of 360º in a circle should not be a surprise. Dividing the zodiac into 28 constellations is closer to the lunar-month of 29.53 days rather than the presently used 27 constellations. With 27 constellations on the 360º arc of the zodiac, the width of each constellation sector is about 360º/27 = 13.33º. With 28 constellations, as in the AtharvaVeda, the sector of a constellation is about 360º/28 = 12.86º, which is closer to the equal division of 12 months in a year.

The above mantra stated that whether you are on the ground or on the water or on the mountains, the Moon is there to tell you where you are in time with respect to the previous day. In the context of the constellations the term in the mantra for the Moon's role is प्रकल्पयन् (*prakalpayan*) which means the 'survey'. This author used its applied meaning in the mantra translation and therefore adapted the Moon's action as 'scaling the constellations'.

The day count by the Aryans was by observing the lunar phase. A completely satisfying answer to the question - why the Aryans had 28 constellations is as difficult as the answer to the question - why the Western civilizations have had 27 constellations. The Veda had practically advised the Aryans to develop and follow a lunar calendar. The Aryans adjusted their lunar calendar with the solar calendar at the end of the solar year, between two successive vernal equinoxes or when it became significant. The adjustment of the calendar with accurate calculations is a practice in Indian astronomy that is still carried forward. Strictly speaking, the Vedic calendar is a luni-solar calendar.

Adding the Moon in a solar calendar was a smart move by the ancient *rishis*. If one loses track of time due to a calamity or any other reason, one cannot get back on track fast enough using the Sun alone. The Sun would give the time of the day accurately but it is the Moon with its changing phases that would give a clue about the day of the month. Therefore, in their wisdom the *rishis* used the Sun for the year and tracked the days by following the phases of the Moon. The reference and nomenclature of the *nakshatras* (constellations) starting in the first Veda, the RigVeda, and listing 28 in a sequence in the AtharvaVeda is quite remarkable. The unambiguous reference of the constellations in the Vedas is a result of highly accurate applied astronomy that descended down from the far antiquity of the Vedic Civilization. After the Vedas provided the nomenclature and established the sequence of the constellations (*nakshatras*), the ancient Brahmana books have talked about

them. For example the Shatpath Brahmana (2/1/2/1-19) has devoted a fair bit of discussion on Krittika and other Nakshatras.

After this brief discussion on the constellations, the Vedic perspective on the Sun and the Solar system is now taken up. As in modern science the Sun for the Vedas is an inanimate (inert) object. The difference however is that the Vedas treat the Sun as a *devata*; a *devata* being a self-sustained system of nature with brilliant properties, an essential participant in the sustenance of the creation in both realms, the animate and the inanimate and functioning in its own realm of the universe. Because the Sun is born much later in the creation and is of no consequence for the rest of the vast creation, it is in the category of a secondary *devata*. It being of immediate importance to the living-beings on the Earth, the virtues of the Sun *devata* are sung in the Veda mantras in variegated ways. Gratitude to the Creator is expressed in the mantras for creating the Sun-*devata* with the properties that sustain life on Earth. Since the science and spirituality go hand-in-hand in the Vedas, the recitation of the physical properties of an inert object (*devata*) of nature is for practising the science associated with it and to express the gratitude to the Sun's creator for practising spirituality. It is in the human nature to branch off with differing emphases on a given subject. This has led to many practices and rituals in the Aryan/Hindu society. For example, while offering *Soorya-namaskaar* (sun-salute) during the yoga practice, water is poured from a hand-held container while facing the Sun because the Sun is the cause for rain and water. People fast on Sundays (Sun's day) and farmers give complete rest on Sunday to the oxen used for ploughing the fields.

One can find tremendous amount of contemporary knowledge in textbooks on solar physics and the planetary science. Here the unique Vedic perspective on the solar system in the realm of physics is presented.

## The Solar System

The solar system is a dynamic entity with all its objects: the Sun, the planets, their satellites and other objects big and small in motion. Yearly cycle of the Earth around the Sun is the Earth's *samvatsar*. The *samvatsar* of the Sun, as the modern astronomy has determined, is 225 million years around the center of the Milky Way Galaxy to which our Sun belongs. The modern astronomers have named this 225 million years long Sun's *samvatsar as the* 'cosmic year'. In Vedic units of Time a 'cosmic year' is 52 *devic*-years; a *devic*-year being 4.32 million Earth-years. The Time-division of the Aryans, presented in detail in Chapter 5 in Volume 1, addresses a *devic-year* of 4.32 million years with several names such as *maha-yuga* and a *chatur-yugi*.

As mentioned in Chapter 9, there is periodicity within periodicity and revolution within revolution in Nature. The process of revolution of the planets around the Sun and the revolution of the Sun around the centre of the Milky Way Galaxy is not the final action of the celestial bodies. The entire Milky Way Galaxy as a single system of

stars with the group of 50 galaxies is said to be traveling in the direction of the Virgo Cluster with a speed of 552 km/second, which in the Vedic scenario of creation is the revolution of the galaxies around the centre of the universe.

In addition to the revolving motion in the planets and the Sun, they all spin around their own axes (the Earth in 24 hours, the Sun in 25.38 days). This behaviour is not limited to the Sun and the planets only. The Milky Way galaxy itself is spinning around its centre. Therefore, within the solar system, if each rotating body is replaced with an imaginary wheel spinning around its axle and going around in an orbit as well, one would have a large number of wheels within wheels with many focal points of motion. The beauty of the system is that with so many foci and conceptual imaginary axles in it, the entire solar system functions like clockwork with each astronomical object within it rendering its own role faithfully without sluggishness, keeping the entire solar system in an orderly fashion.

The Vedas have addressed the Sun with numerous synonyms. Most common synonyms in Sanskrit literature and in common usage are *Soorya* (or *Sooraj*), *Ravi* and *Aaditya*. Before taking up the etymology of some Vedic terms for the Sun that reveal its specific properties, let us look at the formation of the solar system from the Vedic perspective.

## Formation of the Solar System

How did our solar system come to be? The most acceptable modern hypothesis for the formation of the solar system is based on several observational data. One is that the angular momentum (momentum in orbital motion) among all astronomical objects of the solar system is uniformly distributed. The other is that all solar system objects revolve around a spinning focus which is the Sun. Therefore the most accepted hypothesis for the solar system formation is that the whole solar system was created out of one rotating hot mass of matter. The solar physicists have named this hot mass of matter as the "solar nebula". Under this hypothesis about 0.15% of the total mass of the solar nebula ejected out in an explosion or in a solar flayer about 4.5 BY ago; the recurrence of solar flayers is still a feature of the Sun. The ejected matter remained gravitationally bound to the solar nebula, cooled off with time and accreted into chunks that are now well-defined planets. The rotational momenta of all planets and their spin momenta around their own axes together are considered to be part of the total momentum of the ejected mass. The astonishing fact is that the Vedic cosmology also deals with the creation principle of the solar system and surprisingly this principle is basically the same!

There are eight planets in the solar system, all rotating around the Sun and spinning around their own axes. The first four planets - Mercury, Venus, Earth and Mars, in that order from the Sun, called the inner planets, are terrestrial planets with solid surface (crust). The other four outer planets - Jupiter, Saturn, Uranus and Neptune, being gas-giants like Jupiter, are called the Jovian planets. Even these

planets may have a solid core in their interior. Considerable information on the solar system is available in astronomy text-books. However, the novelty of the independent Vedic references pertaining to the solar system will be discussed here.

One striking feature common in the modern hypothesis on solar system formation and the Vedic Creation Principle for the entire universe discussed in the last two chapters is that an explosion in a parent body led to the formation of the astronomical objects. The parent body in the case of the solar system forming the eight planets and their satellites, was brilliantly hot solar nebula and in the Vedic Scenario of the creation of the universe it was one large Golden-embryo (*Hiranya-garbh*) that broke into '*koti-koti*' (countless) smaller Golden-embryos forming the stars and galaxies. Just as the angular momentum of the original solar nebula is conserved within the planets and in the leftover Sun, the angular momentum displayed in all the galaxies and stars is what was in the Golden-embryo before the Vedic Big Bang took place resulting into the spinning and revolving celestial objects. The difference is that unlike the present modern belief postulated by the contemporary Big Bang hypothesis, the Vedic universe spins around its axis carrying countless wheels within one gigantic rotating wheel. The entire universe as a rotating wheel in the Vedic concept resembles the wheel of the solar system itself. In the modern hypothesis if one can have all planets created out of an explosion in one solar nebula, it should not be difficult to conceive that all stars were formed out of an explosion in a galactic-nebula and that all galaxies were formed out of an explosion in the cosmic-nebula called the *Hiranya-garbh* (Golden-embryo). Hence this author emphasized above that the modern hypothesis for the solar system formation is astonishingly similar to the Vedic principle formulated in the mantras in the far antiquity of the human civilization.

The solar system according to the Vedic creation principle started with a small *maartaand* (*hiranya-garbh*), the mortal-ovoid at high temperature, just as the rest of the universe started with one big *Maartaand*. Do the Vedas have more than a statement on the formation of the solar system? Yes there is considerable information specific to the formation of the solar system including the formation of the Earth and the planets. The creation of the solar system is a sub-set within the Vedic creation principle for the universe. This is discussed in the following.

The book of Shatpath Brahmana (10/6/5/2) states that '*aapo va arkah'*, meaning '*aapah are the Sun*'.

Under the Vedic concept of the fundamental state of matter the tri-property *aapah* were discussed in detail in Chapter 5. Here it would suffice to say that the *aapah* in the Vedas, always pronounced in plurality, are the most fundamental seeds of matter responsible for the hierarchy in matter degeneracy forming the first small atoms (Hydrogen) to the last coarser atoms. The word *arkah* (pronounced as urk) is a synonym for the Sun. The Shatpath statement therefore means that the Sun is all *aapah*. Physics of the Sun suggests that the Sun is 92.1% Hydrogen and 7.8% Helium and the rest is in the form of other elements. Hydrogen is the next stage of the most

fundamental state of *aapah*. Thus the statement in Shatpath, that the Sun is all *aapah*, is logical.

A YajurVeda mantra (13/30) –"*apaam gambhantseed sooryo abhitaapseet agnih vaishvaanarah….*" takes us even deeper into the subject. The translation of the relevant part of the mantra states -

> "*The Soorya (Sun) stable on the foundation of aapah provides heat energy from its vaishvaanar form of agni* (energy)*"*.

In the next mantra of YajurVeda (13/31) the Sun is '*apaam-patih'*, *the* ruler of *aapah*. Further in the same 13th chapter of YajurVeda (13/41), the statement "*aaditya garbham payasa samandhi sahasrasya pratima vishva-roopam…*" means –

> "*The payasa (aapah) in the womb of Aaditya (Sun) are the cause for Sun's illumination that reveals and displays with clarity the forms of uncountable substances of the creation…*"

In terms of the cause-and-effect, the *aapah* are the cause for the solar rays that are the cause for the revelation of the geometric perspective of all things. This is the meaning of *revelation and display of forms* in the YajurVeda mantra. It would be ordinary if the YajurVeda mantra had said that the solar rays enable seeing of objects; the extraordinary observation in the mantra is that the Sun reveals the 'forms' of objects.

Just as we raised a question above on how the solar system came to be, the following mantra raises questions on the sequence and the process of creation of *Dhyava* and *Prithvi* where *Dhyava* is the same as *Dyu* discussed earlier. It is the region of the Sun and its immediate brilliant surroundings and the term *Prithvi* is for the Earth. *Dyu* and the Sun are synonymously used in the mantras. The RigVeda mantra is from its 1st chapter's 185th *sukta*, entitled "*Dhyava-Prithivyau devate*", meaning – "*the brilliant region of the Sun and the Earth being the subject*" or simply "the Sun-Earth",

कतरा पूर्वा कतरापरायो: कथा जाते कवय: को वि वेद ।
विश्वं त्मना बिभृतो यध्द नाम वि वर्त्तेते अहनी चक्रियेव ॥

(RigVeda, 1/185/1)

**Transliteration:**

"*Katara poorva katara paraayoh kathaa jaate kavayeh ko vi ved ।*
*Vishvam tmanaa bibhrito yaddh naam vi varttete ahni chakriyev ॥*"

**Mantra Translation:**

*"Who is cognizant with detailed clarity O scholarly to enunciate which one among the two- the Dhyava (brilliant Solar-region) and the Prithvi (Earth), was created first and which one was created later and how they were created? Both acquired their famous names for sustaining their own diverse systems bound in the day-night cycle and in the similitude of a rotating wheel"* RigVeda (1/185/1).

There are several important points to note from this mantra. The rishi of the mantra, named Augustya, raises a two-part question quite similar to those raised today in a science classroom, albeit with a difference that his question is deeper in profundity, as explained below. The question could be put in the category of cause-effect as to which of the two is the cause and which one is the effect. The expression in the first part of the question - *which one was created first and which one was created later,* tells us that there is a sequence in the process. It could be argued that the creation of the Sun and the Earth is simultaneous or that they are two independent events. The way the Sanskrit language utilizes terms and follows its logic system generally reveals what exactly the situation is. The *sukta* heading of the mantra being "*Dhyava-Prithivyau devate*" indicates that the creation of the solar system was in the sequential order with the *Dhyava* (Sun) first and the *Prithivi* (Earth) next. Moreover, the dual plural in *Dhyava-Prithivyau* also indicates that the two events are connected, not independent.

It is obvious from the mantra that the questions are in the realms of both, the history and physics of the creation of the solar system. Answering the second part of the question - *how were they created*, of course required invoking the physical process of creation and therefore is in the realm of physics. Before this is taken up shortly in the following, let us look at the second half of the mantra which talks about the commonality of both supporting their own diverse systems, their tie through the day-night cycle and having the common property of rotation as in a wheel.

There are a large number of Vedic synonyms for the Sun and the Earth. Just 21 for the Sun are presented in the Table 11.4 and 33 for the Earth are presented in the Tables 11.6a, b. One common property of the *Dyu* (Sun) and the Earth is that just as all planets remain bound to the Sun, tied through a periodic revolution, all substances on the Earth remain bound to the Earth which continues in rotation around its own axis like a wheel and carries with it all things tied to it, around the axis of the Sun. The purpose of the questions posed by Rishi Augustya of the 185$^{th}$ *sukta* on the creation of the Sun-Earth system is to inspire the reader to view the subject of the creation of the solar system from the etymological as well as the physical perspective. The answers to the questions however are not simple.

The questions - *which one was created first and which one was created later* and *how were they created* are eons old and were answered eons ago in the ways that existed then. The contemporary history of science would indicate that it took more

than a few past centuries to develop the modern science and its branches, with the solar physics as its byproduct. The modern science puts forward several hypotheses for the formation of the solar system. This suggests that the basic questions in the mantra are not ordinary science questions. Rather they are deep queries, seeking a scientific answer than a religious one. For a common man to understand these modern hypotheses on the solar system, one needs a dexterous and eloquent astronomer.

This author has referred often to the ancient book, Nirukt, by Rishi Yask on Vedic etymology. Rishi Yask had taken up the interpretation of the RigVeda mantra (RigVeda, 1/185/1) with Augustya Rishi's question on what was created first. Based on how one looks at this riddle, several possibilities are there such as (a) the simultaneity in the birth of the Sun and the Earth or (b) the Earth was born out of the Sun or (c) the Earth was born outside the solar system and was captured by the Sun later. It however becomes clear from all related Vedic references that the Earth is born out of the Sun. It is also obvious from the Vedic references that the underlying principle of the formation of all celestial bodies is the same as that presented in Chapters 7 through 9, that just as an explosion in a primary primordial *Hiranya-aand* (Golden-ovate) creates the universe with all stars and galaxies, the explosion in the Sun, a secondary brilliant *maartaand*, creates the solar system. The modern physics named this single smaller *martaand* as the "solar nebula". In the hierarchy of creation the metaphoric rotating wheel of the Earth (and other planets) is embedded within the metaphoric rotating wheel of the solar system.

The following AtharvaVeda mantra (9/9/8) furnishes the Vedic principle specific to the formation of the solar system. Under this principle the Earth and all other planets at one time were part of the Sun. This is no different from the modern hypothesis for the solar system formation. It being one of the crucial mantras, its word-for-word translation is presented with the analysis of several important terms:

*माता पितरमृत आ बभाज धीत्यग्रे मनसा सं हि जग्मे।*
*सा बीभत्सुर्गर्भरसा निविध्दा नमस्वन्त इदुपवाकमीयुः॥*
*(AtharvaVeda, 9/9/8)*

"*Maata pitarmrit aa babhaaj dheetyagre mansaa sam hi jagme* ।
*Sa beebhatsurgarbhrasaa nividdhaa namasvant idupvaakmeeyuh* ॥"

**Transliteration and word Translation:**

*माता* (*Maata*) = Mother Earth, *पितरम्* (*pitaram*) = progenitor the Sun, *ऋते* (*rite*) = under the ritam law of creator, *आ* (*aa*) = within, *बभाज* (*babhaaj*) = separated, *धीती* (*dhiti*) = support, being governed, *अग्रे* (*agre*) = earlier, *मनसा* (*mansa*) = within, confined, *हि* (*hi*) = because, *सं जग्मे* (*sam jagme*) = conjointly together /

*सा* (sa) = that/it, बीभत्सु: (*beebhatsuh*) = desirous of being governed, *गर्भरसा* (*garbh rasa*) = One with fluid in its womb, *निविध्दा* (*nividdhaa*) = was driven away within the bounds of rules or was severed away within the applied rules, नमस्वन्त: (*namasvantah*) = those curved-over, *इत* (*ith*) = also, *उपवाकम* (*oopvaakam*) = differentiated well (by name and place) owing to their nomenclature, *ईयु:* (*iyuh*) = they received.॥

**Mantra Translation:**

"*Under the* ऋतम (*ritam* = laws of creation), *the mother-Earth was terminally separated* (बभाज = *babhaaj*) *from its progenitor the Sun, because* (हि = *hi*), *earlier* (अग्रे = agre) *it was conjointly together* (सम् जग्मे = *sam jagme) with the Sun*. One *with fluid in its* womb (गर्भरसा = *garbhrasa*) the Earth, *desirous of being governed by its protector (the Sun), was appropriately driven away* (निविद्धा = *nividdhaa, severed away)) in the same way as those other ones that curved-over* (नमस्वंत: = *namasvantah*) *towards the Sun and are differentiated well by their names and places owing to the nomenclature they received*." (AtharvaVeda, 9/9/8).

This mantra is from a set of 12 mantras in the 9th *sukta* of the 9th chapter of the AtharvaVeda, enriched with the subjects in physics such as: the creation of the solar system, the axis of rotation, reference to the measure of space in three dimensions (*trishu-yojaneshu* = 3-D), the seven colours of the solar rays, the spreading and stabilizing of the Space, the dynamic wheeler rotation (*chakre*) of celestial objects supported by their non-heating axes (*dhuri*) and so on and so forth. They all relate to the subject of astronomy, state of matter, time-division in 12 months in a year.

The above mantra creates a vivid scenario for the basic process for the solar system's formation because in this single mantra are included the Sun, the Earth, as well as the other planets. Emphasizing the Sun's role in the process the mantra could not have made it clearer that at one point in time the Earth was अग्रे सम् जग्मे (*agre sam jagme*) "*earlier it was conjointly together* with the Sun and was *severed* from it. The term सम् जग्मे (*sam jagme*) conveys with clarity that the Earth before it was created was an integral part of the Sun and not a celestial object which was later captured in the solar system. The adjective for the severance of the Earth from the Sun is निविद्धा (*nividdhaa*) which when translated closest to the Sanskrit meaning, implies that the

Earth was 'driven away' from the Sun or was 'ejected' from it. Therefore this author translated that the Earth was "*appropriately driven away*" from the Sun. The mantra also states that the severance of the Earth from the Sun was not an unexpected sudden accidental event in nature, but was rather an expected process following the laws of creation (nature).

The mantra further emphasizes that not just the Earth was severed from the Sun for good, but also '*those other ones*' that are in their respective and deserved places – meaning they are not all in one place. If the Earth was the consequence of the matter separating from the Sun, '*those other ones*' in the mantra, that also separated from the Sun, must be the rest of the objects of the solar system in their own orbits; the planets in particular. This is the Vedic principle for the formation of the solar system and is no different from the most accepted modern hypothesis on the solar system.

It is indeed mind-boggling to think that the Vedic *rishi* must suggest that the vast Earth was created out of the Sun, when the latter to a naked eye is apparently a tiny object moving in the vast sky! That the Earth is controlled by the Sun and that it is born out of the Sun is not just a fleeting reference here: the Vedas carry the same amazing theme in a large number of mantras. The *rishis* have known that the Earth is huge because they have said so variously the mantras with differing adjectives. The apparent disc of the Sun measures in inches only (about half a degree arc). Therefore for the great Earth to have been created out of the Sun, the *rishi* must have known that the Sun is much bigger than the Earth. This is remarkable in itself. To top it all, the *rishi* in the above mantra states that '*those other ones*' are also born out of the same Sun. All this is no different from the modern theory of the solar system formation.

The mantra states that '*the other ones'* born in the same way as the Earth were in a नमस्वंत: (*namasvantah*) to the Sun. The *yaugik* meaning of the term *namasvantah* is - *respectful attraction towards someone, expressed by bowing posture*', as one bows with folded hands towards a senior person, a king or a deity. In the case of the inert entities, the bowing of a planet towards the Sun implies that the planet is attracted to the Sun. An attraction of an inert mass towards another mass, as we understand it now, is nothing else but gravitational attraction. This was understood by the *rishis* as such and they termed it as '*gurutva'*. A discussion on *gurutva* (Gravitation) is in the following, under the sub-title of "*Prithvi*: the planet Earth".

Compared to the *yaugik* (root-based) meaning of the term नमस्वंत: (*namasvantah*), the *rudhi* (coloquival) meaning in common usage is is 'curved-over' or 'bowed-over' or 'leaned-over' towards the Sun. What then is the meaning of the planets placed in their specific places, leaning or bending or bowing towards the Sun?

The *rudhi* (common) meaning of the expression *namas-vantah* to the Sun represents a physical process to curve-over towards the Sun. This can be seen as all planets initially were arcs of matter with their curvatures towards the Sun or that they have curved paths around the Sun. Either way these 'other ones' in the company of the Earth were none other than the rest of the planets of the solar system which also

were created in the same manner as the Earth; from the chunk of matter that separated from the Sun. The physical picture that the term *namas-vantah* conveys is that the object in *namas-vantah* has some length in it to exhibit curvature towards the Sun. This suggests an arc of matter and excludes a complete circle of matter. This may suggest some differences in the Vedic scenario of the formation of the solar-system and the modern view, both scenarios presented pictorially in the following.

For the formation of the planets in our solar system there is one other modern hypothesis suggesting that some solar matter separated from the Sun which initially was in the form of a disk and this disc further separated into different concentric rings of matter. These individual rings slowly coagulated into individual planets. This modern scenario is presented on the left side of Figure 11.1.

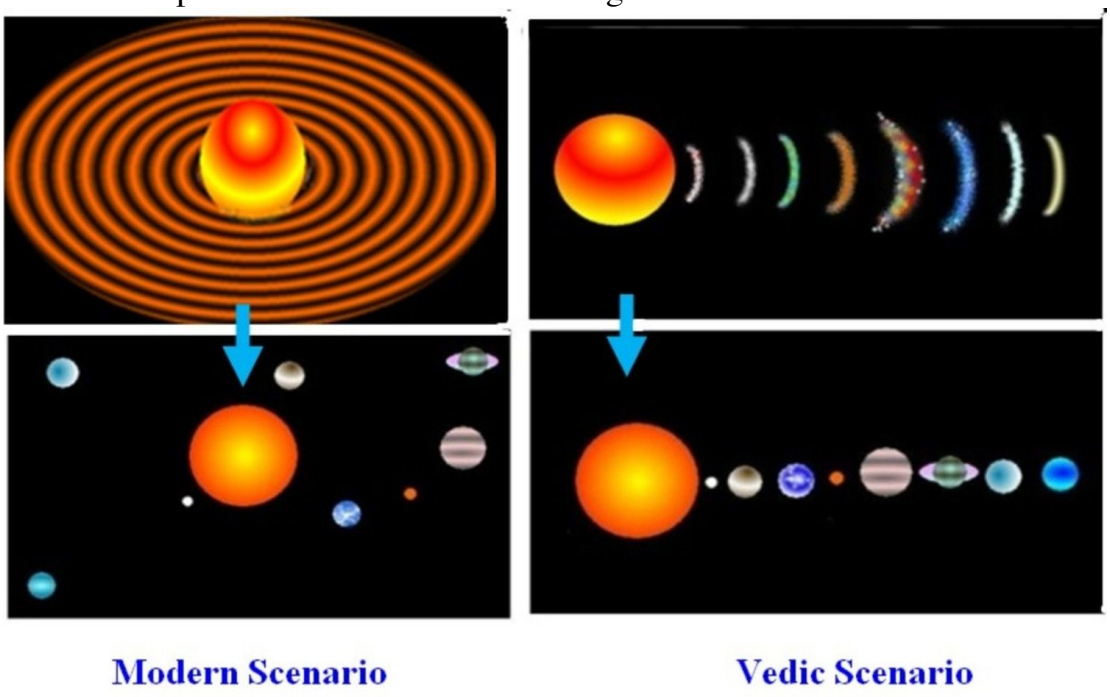


Figure 11.1: Solar-system formation in Modern Scenario (left frames) and Vedic Scenario (right frames).

The upper frame of the figure depicts the Sun in the center with the rings around it. The individually formed planets are shown around the Sun in the lower-left frame. In this scenario the planetary material would coagulate at arbitrary positions with the major gravitational influence being that of the Sun.

In the Vedic scenario of the solar-system formation, depicted in the frame on the right side of Figure 11.1, the curving of the matter-bands towards the Sun represents a meaning closest to *namas-vantah* in the mantra. In this scenario the explosion in the Sun throws the matter to one side of the Sun and probably a single event initiated the formation of all the planets on one-side of the Sun; the most likely scenario. Under the Sun's gravity a pressure wave could create cusps in the flying matter and create

density distribution in several zones along the direction of the explosion. The coagulation of matter to form the planets is faster in this scenario where the planets, as suggested in the mantra, occupy their *specified places* (distinct orbits) sooner.

The other reason for this author to think of such a Vedic scenario for the solar system is the consistency within the Vedic creation scenario with regard to the universe settling into an order relatively sooner than 13.8 BY of Big Bang. It was discussed earlier that the primary process was the main *Maartaand* breaking into uncountable smaller *maartaands* with the Nature hurling them all into the vast space and the secondary process was the beginning of the simultaneous formation of all cosmos in all regions of the universe. This would have expedited the process of creation. The Vedic calendar discussed in Chapter 5 under the measurement of Time by the Aryans, begins with all planets formed simultaneously and initially aligned on one side of the Sun.

Initiation of the planet formation on one side of the Sun does not mean that they are all tied to remain on the same side and aligned. Their differing orbital periods around the Sun would misalign them because they would be arriving at their original positions on their respective orbits at different times. However, it is to be noted that according to the Vedic astronomy, as this author has understood it, all or most planets in their individual orbits are found in alignment (on one side of the Sun) at the beginning of a *maha-yuga* and that is the basis for the time epochs in the Vedic *srishti* (creation) calendar (details in Chapter 5). The alignment of planets is pre-calculated and predicted using ancient indigenous astronomy calculations and the moment of alignment is celebrated by the Aryans of India. Even though a complete alignment of all planets takes place at the beginning of a *maha-yuga* all partial alignments are celebrated as a sign of the birthday of the universe.

An important adjective for the Earth has been used in the above AtharvaVeda mantra. The mantra states that the Earth is **गर्भरसा** (*garbhrasa*). The meaning of *garbhrasa* is '*one with fluid in its womb* (interior)'. The Earth with fluid in its womb, which as we know it now is the "molten lava", a credible Vedic geological observation! This is further discussed under the sub-heading for the Earth. As pointed out above, the modern observations about the Earth and the hypotheses for the formation of the solar system are not very different from this Vedic principle; the difference of course is that the latter was independently formulated eons ago in the mantras. Also, the mantra that states a remarkable principle regarding the solar-system formation is not a fluke because there are more mantras that support it. For the sake of brevity they are not dealt with here and we instead proceed to discuss the other features of the solar system from the Vedic perspective.

# Physical Features of the Solar System

In the context of the shape of the universe, a RigVeda mantra (7/63/2), with detailed word-for-word translation, was presented in Chapter 9. Among other physics points in the mantra, it had drawn a simile for the shape aspect of the universe and the solar-system. This mantra is revisited here:

> *"The self-existent progenitor of all humans is the one who creates and controls the universe which functions in the vast Space (*अर्णव: *= arnavah) and remains confined within its circumference (*परि आविवृत्सन् *= pari aavivritsan), analogous to (*समानम् चक्रम् *= samaanam-chakram) the rotating wheel of the Sun (*सूर्यस्य *= Sooryasya). The special energy* एतश: *(etashah) embodied within the axes (*धूर्षु *= dhoorshu) of all (celestial objects) is the stimulus to their controlled motion. This is revealed in the minds of highly disciplined and enlightened humans."* (RigVeda, 7/63/2).

If the spirituality in the mantra and the credit given to a self-existing progenitor of humans and cosmos is is set aside, one is still left with quite a bit of important physics in this mantra. The mantra's pronouncements such as: the universe in the vast Space; universe's confinement within its circumference - implying that it is circular; universe analogous to the rotating wheel of the Sun; the cosmic objects rotating around with flow of energy through unique axes (rotational energy) and the motion around the axes are all observations in the realm of physics. Although the solar system (Sun and the orbiting planets) does not rotate as a rigid wheel, all the planets possess angular momentum around one axis, the axis of the Sun and the system remains within the circumference assigned to it. This circular motion, in the way similar to a wheel rotating around an axle, is the Vedic principle stated unequivocally in this mantra and repeated in many more. This mantra basically describes the shape and functioning of the solar-system by drawing a simile between the shape and functioning of the universe – that the rotating wheel of the universe is analogous to the solar system wheel (समानम् चक्रम् = *samaanam-chakram*). The orbits of all the planets around the Sun are confined in a narrow plane. The variations and gravitational influences by other objects in the early stages of the solar nebula must have created the tilt of the orbits of the planets. However, as the mantra has indicated, they remain confined within their own circumferences. The *rishi* of the mantra (RigVeda, 7/63/2), deducting this from the observations from the Earth and calling it Sun's wheel is a remarkable feat in astronomy!

The recognition of an axis of rotation in a system and to have the right and meaningful vocabulary to express it with utmost clarity is an important step in physics

that this Veda mantra exhibits. The term *dhoor* in *dhoorshu* (धूर्षु) stands for an axle. The term *aksha* stands for axis. The term *dhoor* for the axle in this and other Veda mantras for the Sun and other celestial objects and the term *aksha* for axis in other Veda mantras for the Sun and other celestial objects, stand for one and the same thing – the rotational axis. When one looks up at the Sun, one does not see a physical axis passing through the Sun's disk. But, the axis of rotation around which an object or objects rotate was recognized by the ancient *rishis* and they assigned the appropriate term to it. This RigVeda mantra associates a *dhoor* (axis) to the wheel of the Sun (solar-system).

The pronunciation of the term *aksha* for axis sounds similar to the word 'axis' in English. The axis of rotation is depicted by several Veda mantras in differing contexts. An unparalleled clarification between a physical axle of an ordinary wheel and the conceptual axis of the solar system is stated in the following mantra which takes us deeper into the Vedic physics. This author termed it as 'Vedic physics' because the mantra delineates physics in a unique Vedic way. Here is that RigVeda mantra, presented with word-transliteration and word-translation:

पञ्चारे चक्रे परिवर्त्तमाने तस्मिन्ना तस्थुर्भुवनानि विश्वा ।
तस्य नाक्षस्तप्यते भूरिभार: सनादेव न शीर्यते सनाभि: ॥ (RigVeda, /164/13)

**Word Transliteration and Translation**

पञ्चारे (*panchaare*) = five-spokes, चक्रे (*chakre*) = in the wheel, परिवर्त्तमाने (*parivartmaane*) = all parts of it rotating around together, तस्मिन् (*tasmin*) = of that, आ तस्थु: (*aa tasthuh*) = established in/stably present, विश्वा भुवनानि (*vishva bhuvanaani*) = all individual celestial bodies ।

तस्य (*tasya*) = of which, अक्ष: (*akshah*) = axis/axle, न तप्यते (*na tapyate*) = neither heats up, भूरिभार: (*bhoori-bhaarah*) = is of enormous weight, सनादेव (*sanaadev*)= from the very beginning / from the beginning of creation, न शीर्यते (*na sheeryate*) = nor it wears out/ nor it fractures, सनाभि: (*sanaabhih*) = implanted in the focus/implanted in the center ॥

**Mantra Translation**:

*"In the wheel with five spokes, rotating from all sides (as a system), are stably established all cosmic objects. Rotating from the beginning of creation, this wheel has in it an axis* (अक्ष: = *akshah*) *firmly implanted in its focus* (सनाभि: = *sanaabhih*, *hub*) *that even with the enormous weight of the system, it neither heats up nor fractures,"* (RigVeda, 1/164/13)

The subject heading of the *sukta* 164 of the above mantra is *Vishve-deva*, which means the 'universe'. Therefore the wheel and the axle in the mantra do not relate to an ordinary wheel of a chariot; they relate to the universe. In a rotational system the rotation of the mass is around its axis. In this mantra it is the *नाभिः* (*naabhih* = the center) in the term *सनाभिः* (*sanaabhih*) of the system where the system's अक्षः (*akshah* = the axis) is located. The last word of the mantra सनाभिः (*sanaabhih*) is a conjugation of स + नाभिः (*sa* + *naabhih*) where the word नाभिः stands for the center or the focus and the two words together in सनाभिः express that its अक्षः (*akshah*) is implanted in its center (focus). One other important observation from the mantra is that the rotating mass of the system is pluralized in *विश्वा भुवनानि* (*vishva bhuvanaani*). This means - '*all individual celestial bodies*'. The term *bhuvanaani* is the plural of the term *bhuvan* which has no other meaning than a celestial body. Therefore, it is glaringly obvious that the mantra is talking about the rotating universe with all its celestial objects rotating around an axis.

It was mentioned several times that symmetry prevails at different levels of the creation. Therefore, whereas this mantra applies to the whole universe which according to the mantra is in continuous rotation like a wheel around an axis of rotation, it also applies to a rotating galaxy with an axis of rotation and to a solar system rotating around its own *नाभिः* (*naabhih*) the focal point, including our Sun with all its planetary bodies rotating around its axis. When this author emphasized the symmetry aspect of the Vedic creation of the universe, it is comforting to note that the modern astronomers also have noted considerable symmetry in the creation and used it in their favour, an example of this being the working-out of the coordinate systems. The Astronomers, having observed the similarity in the shape of the solar system and that of our Milky Way Galaxy, adopted a similar coordinate system for both. The plane of the galactic disc forms the galactic equator in the same way as the plane of the solar system disc forms the celestial equator.

In 'a-rotating wheel-within-a-rotating wheel' scenario for the celestial systems in the Vedic creation, the mechanics delineated in the above mantra (RigVeda, 1/164/13) also apply to the rotating wheel of the solar system. The mantra references to the solar system as a wheel, both in the RigVeda and the AtharvaVeda, have occurred in differing contexts and were taken up for interpretation by the ancient rishis who have written in-depth commentaries on them. The simile of a wheel for a solar system does not mean that all rotating wheels are physically identical. For example the mantra's numerical count of spokes or of its rim-sectors would have different meanings for the wheels at different cosmological scale. The five spokes of the wheel in this mantra for the universe, according to ancient mantra interpretation, represent the five classes of matter sensed by the five knowledge senses; the most observed form of matter being the substantive cosmological bodies, a subject for the sense of seeing.

Several other mantras in the same *sukta* of RigVeda while addressing other aspects of time, space and the Earth draw similarity between a rotating wheel and the solar system. In addition to the term *विश्वा भुवनानि* (*vishva-bhuvanaani*) **representing "all individual celestial bodies"** the other important term in the above mantra is भूरिभार: (***bhoori-bharah***) which translates into **'*of enormous weight*'**. No matter how one looks at the meaning of this term it will only yield a meaning that stands for – "**of enormous weight**". In the context of the solar system, the enormous weight referred to in the mantra represents the weight of the wheel of the solar-system formed of the planetary system including the Sun. This weight is real and the axle supporting it of course is a non-real conceptual entity. The comparison of the axis of rotation of the solar system and a physical axle of a common wheel is remarkable. The axle of the solar wheel never heats up nor fractures (RigVeda 1/164/13) unlike the axle of a common wheel which is prone to these two specific defects. The fact is that the humans have observed the axle of a rotating wheel heat up and ultimately break down after wearing out, but they have not seen a wheel the axle of which does not heat up or fractures in spite of **enormous weight** on it. In the local part of the universe such an enormously heavy wheel is the wheel of the solar-system. Then, an enormously heavier wheel is the wheel of our Milky Way Galaxy. In this hierarchy the next enormously heavy wheel is the wheel of the rotating universe.

The poetic beauty of the mantra makes it clear that it is an imaginary axis of rotation, not made of iron as for a wheel of a vehicle. It is noteworthy that the Vedic term in the mantra for wear-out, break-down or grind-out of the axle is *शीर्य* (*sheerya*) which sounds similar to the English word 'shear' conveying the same meaning. It is the wheel of the cosmos with an imaginary axle carrying enormous weight of the entire universe, $10^{60}$ kg suggested by cosmologists, which is rotating for billions of years without heating or shearing. The *rishis* had conceptualized that the universe as well as the solar system were enormously heavy.

To deal with the time aspect of the solar-system in the Earth's frame of reference, the RigVeda in another mantra (1/164/11) states that the 12 rim-sectors of the solar-wheel represented the twelve months of the year. Other counts in the mantra are 360 and 720. The numeral 360 represents 360 days of the Vedic year as well as the 360 divisions of a circle, each division being a unit measure of an arc on a circle – yet another gift of the Veda to geometry and trigonometry. The number 720 in another mantra represents the days plus nights in one year.

## Vedic Distinction between the Sun and the Planets

**Table 11.2:** Vedic names of the objects of the solar system. The maximum apparent diameter D in the last column is the angle-width of the

| observed disc of the object ( in minutes of an arc noted from modern astronomy). | | | |
|---|---|---|---|
| **Vedic Name** | **Astron. Name** | **Vedic Reference** | **D** |
| *Aaditya*/ Soorya / many synonyms | Sun | RigVeda (1/50), SaamVeda (6/3/14/), AtharvaVeda (7/107/1) + large number of refs. | 32.7' |
| Budha | Mercury | AtharvaVeda, SamVeda refs. | 0.22' |
| Ven (Shukra ) | Venus | RigVeda (10/123/1-8), YajurVeda (8/49, 33/33) | 1.1' |
| Prithvi | Earth | Large number of references | - |
| Chandra | Moon | Large number of references | 34.1' |
| Mangal | Mars | YajurVeda (16/6) | 0.42' |
| Brihaspati | Jupiter | RigVeda(4/50/4) | 0.82' |
| Shanaishchra | Saturn | Large number in Vedic Lit. | 0.33' |
| (Varun) | Uranus | Not in "Soorya Siddhant" | 0.07' |
| (Prajapati) | Neptune | Not in "Soorya Siddhant" | 0.033' |

In the ancient Sanskrit dictionaries, the Sun is defined as the *griha-pati*, meaning "*the master of grihas"*. This certainly reveals that the Sun is bigger than a *griha* and designated as the master (*pati)* of the *grihas* because it controls many *grihas*.The Vedic term for planet is griha. Nirukt (3/3) etimology defines the word griha as 'grinanti iti sataam' meaning 'that which receives'. The common meaning of the term griha is 'house' because it receives and houses objects and people and it is the place where things are placed and stored.

Therefore, all planets are *grihas* because they are the places for inert and living objects. Just as a planet is identified with its name given to it by astronomers, the Vedic system of astronomy has meaningful Sanskrit names for all the *grihas*. A YajurVeda mantra (33/43) tells it all. The translation of this mantra is:

"*The Savita (Sun) with its brilliance makes the bhuvanani (astronomical bodies) visible and owing to its power of attraction (krishnen) keeps them in orbital motions (aa vartamaanah) in their individual orbits and following the routine of rise and set enables the utility of life-sustaining water and space for living-beings*". YajurVeda (33/43).

Thus, the properties of *Savita* (Sun) are distinctly different from those of a planet like Earth. In the Vedic system the succession of all planets starting from Mercury to Saturn is the same as in western astronomy. Although it is well recognized and stated in the mantras that the Moon revolves around the Earth and that all planets revolve around the Sun, the Moon is counted as a planet. It is also well-known that Hindus count planets as *nava-griha* (nine-planets), but this author was not able to pin-point the Vedic references naming the last two planets, Uranus and Neptune. Some Indian authors have suggested that the Uranus and the Neptune are mentioned in the Veda mantras as *Varun* and *Prajapati* respectively. The mantra references on these two planets are inconclusive and therefore left blank in the Table 11.2.

Just as the 12 months of the year in the Vedic system are sequentially named after their constellations, the seven days of the week are named after the Sun, Moon and the five planets (Table 11.3). The names of the days in the week are not in the same order as the sequence of the planets in the solar system. It is possible that because the last two planets, Uranus and Neptune, are invisible to the naked eye, they were not included in the nomenclature of the week-days. This is a common feature in both, the Western and Eastern astronomy.

**Table 11.3:** Vedic nomenclature for the days of the week.

| **Vedic Name of Day** | Ravi | Som | Mangal | Budha | Brihaspati | Shukra | Shani |
|---|---|---|---|---|---|---|---|
| **Planet Association** | Sun | Moon | Mars | Mercury | Jupiter | Venus | Saturn |
| **English Name** | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |

This author has researched Vedic literature to bring to the reader some characteristics of the planets described in the Vedas. Several authors of Indian origin have identified some mantras related to the planets and the solar system in general and have written commentaries on the same in the Hindi language and some in English. For the benefit of the English readers this author has carefully noted some of the references cited by these authors in their work. This author has found that some of the correlations of the Veda mantra references and the astronomic deductions drawn by some of these authors are questionable because some of them are conjectures based on mistranslations of the mantras. Nevertheless, based on the Veda mantras, this author will present information in some detail on several of the planets and only make brief comments on the rest.

The Vedic perspective on the planet Earth is presented here. Even the discussion on the physics aspect of the planet Earth has been kept short in this chapter. There is so much important material in the Veda mantras on the subject of the Earth that a separate book could be written on it. However, the restricted presentation on the Earth, the Sun and the planets included in this chapter should suffice to show that the Vedic *rishis* studied the Earth, observed the planets and drew some remarkable conclusions that are unique in the science arena.

## Soorya: the Sun

The term *Varun* in the RigVeda mantra (1/24/10) cited above is a common synonym for the Sun. The analysis of the term *varun* with the other two synonyms of the Sun, *Aditi-putra* and *Aaditya* are included here. An interesting insight in astronomy by the Vedic *rishis* is obvious in their usage of the term *Maghavan* for the Sun that was discussed in the beginning of the chapter. The enriched Vedic terminology has a large number of synonyms for the Sun as well. This author has limited the number in Table 11.4 to only 21.

**Table 11.4:** The 21 Vedic synonyms for the Sun, in alphabetic order.

| No. | Sun's synonyms | Word meaning | References |
|---|---|---|---|
| 1 | Aaditya | takes away all darkness; also, one that has beginning and end in it | RigVeda (1/51/13); Shatpath (6/1/2/3); Brahm Purana (24/75,76); Nirukt (2/4/1) |
| 2 | Arkah | illuminator of all paths, born of aapah | Shatpath(10/6/5/2), Nirukt (12/2/7) |
| 3 | Ashma-prishni | because the Sun is like a brilliant stone | RigVeda(5/47/3); Shatpath (9/2/3/14) |
| 4 | Bhagh | one that is not seen at night but is there | Nighantu (8), Nirukt (12/2/1-2.) |
| 5 | Bhaanu | the illuminator | RigVeda(10/37/4) |
| 6 | Indra | creator, ruler (of planets), cause of rain, | Too many to include here |
| 7 | Kavih | one with broadened sight | Nirukt (12/2/20) |
| 8 | Keshi | one with light rays as its hair | RigVeda (10/136/1-7) |
| 9 | Maghvan | *maghvan* because it controls an independent region of space named *rodasi*. | Nirukt (6/1/2) |
| 10 | Nishant | one who ends the night | Vedic literature |
| 11 | Ooksh | rain-maker, helps create life on Earth | RigVeda (5/47/3; 10/31/8) |
| 12 | Poosha | complete with brilliance and radiating rays of light | Nighantu (10), Nirukt (12/2/1,5) |
| 13 | Prajapati | master of its population (planets etc.) | Several places in the Veda |
| 14 | Ravi | with brilliance | Vedic literature |
| 15 | Savita | giver of birth to all (inert planets, substances, living-beings), … | Nirukt (10/3/7) , Nighantu (7) |
| 16 | Soorya | (see discussion below on its three roots) | Nighantu (9) |
| 17 | Tarani | fast reaching all | RigVeda (1/50/4) |

| | | | |
|---|---|---|---|
| | | (to illuminate) | |
| 18 | Tvasht | The illuminator | RigVeda Samhita (1/6/7/15), Nirukt (4/3/4/1) |
| 19 | Varun | brings prosperity through rain and water on Earth | RigVeda (1/24/10), + many |
| 20 | Vishnu | illuminates in three steps | Nighantu (11), Nirukt(12/28) |
| 21 | Vrishabh | The rain-maker | RigVeda (3/38/5), YajurVeda (8/49) |

How the in-depth study of creation and its objects was carried out by the Vedic *rishis* is exhibited when one studies how the Vedic terms were derived and what they actually mean. It is also remarkable to note that the ancient rishis also provided the analysis of the terms that they derived. Let us look into the etymology of a few of the most common terms for the Sun.

## Etymology of the Vedic Names of the Sun

It was mentioned in earlier chapters that a Vedic term defines an entity in terms of its properties. Many properties lead to many synonyms. The root of the synonym (term) and the root analysis yield the identity of that entity. This system strives for perfection by differentiation. For example, when the Sun illuminates the upper part of the space with the lower part still in darkness, as in the early twilight period, the Sun is addressed as ***Savita***. The meaning of the term '*savita*' according to Nirukt (10/3/7) is '*one that gives birth to all*'. Implicit here is that whatever is born on the Earth is ultimately due to the Sun. This period of the Sun is also the period when the Sun gives birth to all activities on the Earth by bringing all living beings out of the *sushupti* (sleep).

The most used Sanskrit term for the Sun is ***Soorya***. It is analyzed by Rishi Yask in his book of Nirukt (see also Pundit Sitaram Shastri's commentary in Hindi, Parimal Publications, Delhi, 2005). The Nirukt (12/2/3) states that the सूर्य (*Soorya* = Sun) is: सत्तेर्वा[1] । सुवतेर्वा[2]। स्वीर्यतेर्वा[3]। (*satterva[1], suvaterva[2], sveeryaterva[3]*). This means that three different Sanskrit *dhaatu* (roots) representing three different properties lead to the formation of the single word ***soorya***. The term *Soorya* therefore reflects three specific properties of the Sun in the same name *Soorya*. The other properties of the Sun are reflected in the other synonyms of the Sun. These three roots in the term *soorya* respectively are:

*sra[1] root for motion, soo[2] root to give birth and eer[3] root for its beauty displayed by air.*

The Sun is seen in motion, is responsible for the birth of all planets and all living creation and it is the most beautiful object whose adornment is enhanced by the air of the atmosphere. This is why the Sun is the ***Soorya***.

The other most common term for the Sun is ***Aaditya***. Nirukt (2/4/1) provides its etymology in terms of four different meanings of which three are specific to the Sun and the fourth is common to the Sun as well as the other entities of creation that also have a similar property. They are:

(1) one that does '*aadaan*' of the *rasas* (receives the nutrients in fluid state) as in '*aapah being consumed by the Sun to create light rays*'. The light rays are absorbed in terrestrial water and create clouds;

(2) one that takes away the illumination of the *nakshatras* (constellations);

(3) one that is '*addepto*', meaning the one that is covered by illumination and

(4) because it is '*aditi-putra*' (*Aditi*'s progeny).

Recalling that the *Aditi* of the Vedas is the same as the Nature-entity, the adjective of '*aditi-putra*' for the Sun takes us a step closer to the creation process of the universe itself. The name *aditi-putra* could be for any entity created out of *Aditi*, such as all the 7 *devas* (*Aditi*'s 7 progeny) discussed in Chapter 8 and all that exists in the universe. However, the term *aditi-putra* leading to the synonym *Aaditya* for the Sun, in the context of creation and illumination, is more specific to the Sun.

In his translation and interpretation of the RigVeda mantra (1/51/13), Swami Dayananda Sarasvati added a further interpretation of the term *aaditya*. The Sun is *aaditya* because it has *aadi* (beginning) and *iti* (end), *aadi+iti = aaditya*, of our own creation enclave that we address as the 'solar system'. In addition to the other meanings of the term *aaditya* he includes - '*one that provides the continuity in creation by having the beginning (aadi) and the end (iti) in it*'. Because the Sun plays various important roles in this creation, the RigVeda and three other Vedas have devoted many *suktas* and mantras to the Sun under its different synonyms.

After the 7 *devas* as the first creation of Nature (*Aditi*) there are in all 33 other *devas* that are also established in different aspects of the creation which together help sustain Nature in its *Aditi* state of creation. The Sun in the Vedas is one of the most important secondary *devas* included in the 33 that play a vital role in the established creation. For the sake of brevity the etymology of the other Sanskrit terms for the Sun is not taken up here.

## *Aapah* the Fuel of the Sun

The questions - what keeps the Sun going, from where does it get so much fuel to give out enormous energy and what is the Vedic perspective on the Sun's fuel, are briefly discussed below.

Of the many *suktas* devoted to the Sun just a few mantras from a few *suktas* are presented here. Direct translations of two mantras from the *Soorya sukta* 37 of the 10th Chapter of RigVeda are presented below:

> *"Revealer of air and water, giver of light rays, remote-seen* (दूरेदृशे = *dooredrishe*)*, illuminator of all, O enormous deva of brilliant qualities, you are the progeny of radiance. For this O Soorya, we bow in gratitude and recite your virtues."* RigVeda (10/37/1)

> "*Well-manifest in its brilliant light the Sun owing to its gravitational property* (अक्तुभि: = *aktubhih) of attraction and grasp, keeps all the planets* (विश्वा भुवनानि = *vishva bhuvanaani) attracted to itself and in motion (*प्र च ईरते = *pra-cha-eerate), contained within their confinements* (निविशन्ते = *nivishante). Let the Soorya, whose hair* (हरिकेश: = *hari-keshah) being its rays of light, rise without deficiency, bringing prosperity every day.*" RigVeda (10/37/9).

Both mantras are self-explanatory; however, a few points are worth mentioning. The first mantra has used an interesting adjective for the Sun, the दूरेदृशे (*dooredrishe*) - meaning "*one that appears faraway*". The apparent solar disc is about half a degree (maximum 0.545° =32.7' minutes) wide which is sometimes seen to be even smaller than the Moon's (see Table 11.2). Therefore those who had no knowledge of cosmology, astronomy or solar physics could easily have concluded that the Sun was a small body. But the revealer of these mantras, Rishi Amitpaa Saurya, states that the *Soorya* is '*enormous*' and that it is observed to be small, as the mantra stipulated, because of the दूरेदृशे (*doore-drishe*) effect, in which an object gives rise to the perception of being small because it is *remote-seen*. The Sun and the Moon, both send light on to the Earth but it is only the Sun that is said to be a manifestation of illumination. In fact in the section on the Moon to follow, a mantra is presented that states with amazing clarity that the light received from the Moon is that of the Sun.

In the second mantra cited above the important Sanskrit terms are included in the translation because this mantra delineates clearly what the Sun is and its function and relationship to the planets is. Surprisingly the function of the Sun and its relationship to the planets stated in the mantra is no different from what is now understood.

An important feature of the second mantra is the Sun's relationship to the भुवनानि (*bhuvanaani*). The term *bhuvanani* has no other meaning, in whatever context one chooses, than the plural word for 'planet'; *bhoo* for the Earth being one of them. The Sun not only illuminates all substances around it, it keeps all planets in motion and holds them within their orbits due to its property of gravitational attraction, which in the mantra is *aktubhih*. This mantra also substantiates the AtharvaVeda mantra (9/9/8) presented under the sub-heading of "Creation of the Solar System", wherein the planets (भुवनानि = *bhuvanaani*) were said to be curved towards the Sun (नमस्वंत: = *namasvantah*) and confined in their own orbits. The recognition in the mantra that the Sun illuminates all substances around it and keeps all planets in motion and holds them within their orbits due to its property of gravitational attraction (*aktubhih*) are brilliant deductions drawn by the Vedic *rishis*. The deductions pertaining to the Sun are in the realm of physics and are remarkable because without a deep physics insight, a bright disc in the sky subtending an angle of half a degree only, appearing even smaller than the disc of the Moon, could not have been credited to command so much.

Let us now go back to the 50th *sukta* of RigVeda's 1st Chapter and study some of the unique observations on the Sun. The *devata* (subject) of this *sukta* is the *Soorya* (Sun). As expected, the mantras in that *sukta* also relate to physics, specific to the Sun.

An extremely beautiful short mantra appears both in the RigVeda and the YajurVeda that defines the Sun and some of its major attributes:

तरणिर्विश्वदर्शतो ज्योतिष्कृदसि सूर्य्य ।
विश्वमा भासि रोचनम् ॥
(RigVeda, 1/50/4 and YajurVeda, 33/36)

**Transliteration:** "*Taranirvishva darshato jyotishkridsi Soorya । Vishvamaa bhaasi rochnam*" ॥

**Word Transliteration and Translation:**

तरणि (*Tarani*) = the Sun, विश्वदर्शत: (*vishva-darshatah*) = observed by all / one that illuminates the worlds, ज्योतिष्कृत् (*jyotishkrit*) = creator of light / illuminator of others, सूर्य्य (*Soorya*) = The Sun ।विश्वम् (*vishvam*) = the entire world, आ भासि (*aa bhaasi*) = revealer of all, रोचनम् (*rochanam*) = pleasing to the mind ॥

**Mantra Translation:**

*"O Sun, the self-illumine Tarani, you reveal the beautiful world by reaching all. By illuminating all, you make the world extremely pleasing."* RigVeda (1/50/4), YajurVeda (33/36).

In addition to embellishing the mantra with several synonyms of the Sun the *rishi* has embedded adjectives in it like the brilliant gemstones on a beautiful ornament. The Sun (सूर्य्य = *Soorya*) in this mantra is addressed as तरणि (*tarani*) (synonym 17 in Table 11.4) and ज्योतिष्कृत् (*jyotishkrit*). The term '*tarani*' represents an action and *jyotishkrit* represents a property. *Tarani* means the '*one that invades all*' or '*enters all*' or '*reaches all*'; the latter more in context. The Sun invades all with its property of *jyotishkrit*, which means '*one that illuminates*'. When closely analyzed the term *jyotishkrit* represents the property of '*self-illumine that does not need extrinsic source of energy*'. In the Vedas there is considerable discussion on planets that send out a glow of light, however, the term *jyotishkrit* (self-effulgent) is not used for them, not even for the Moon which in Sun's absence illuminates the Earth at night. Just as *nakshatra* is the Vedic term for the stars, for they never exhibit decay with time, the Sun is addressed as a *jyotishkrit* for it is '*self-sustained in illumination*'. This is an excellent one-word physics definition that fits the Sun.

The other adjectives for the Sun in the above mantra are under the **Word Transliteration and Translation:** विश्वदर्शत: (*vishva-darshatah*) = *observed by all or one that illuminates the worlds,* आ भासि (*aa bhaasi*) = *revealer of all* and रोचनम् (*rochanam*) = *pleasing to the mind*.

In early civilizations, before electricity was harnessed and nuclear power was discovered, the source of man-made light or fire was firewood or fluids like butter and oil. The Sanskrit words for the ingredients that can generate fire are *idhma* and *eendhan,* which are equivalent to the generic word 'fuel'. A natural question that the early civilizations must have raised is – 'What fuel burns in the Sun to create so much light and heat?' Whatever might have been the answer to this question in the other civilizations, the Vedic Civilization had an answer in the RigVeda mantra (10/30/4) millennia ago. The Sun in this mantra is said to be the अनिध्मो दीदयत् (*un-idhmo deedayat*), which means that it '*has illumination without idhma*'. Simply put, the terms *un-idhmo deedayat* mean that the Sun's illumination is without firewood or other common ingredients used for creating light and fire. Awareness of this physical property of the Sun and its *jyotishkrit* self-effulgence are consistently expressed in Vedic thought. So, if not thwood what is Sun's *idhma* (fuel)?

The Vedic answer to the question about the Sun's fuel is the Sun itself. The references presented above (YajurVeda, 13/30, 31, 41) state that the Sun is *aapah*; '*the Soorya stable on the foundation of aapah provides heat energy from its vaishvaanara form of agni';* the Sun is the '*apaam-patih' the* ruler of *aapah;* the *aapaah* are in the womb of *Aditya* (Sun) that produce light causing *revelation and display of forms of uncountable substances of the creation*..; all these lead to the Vedic deduction that *aapah* are the fuel of the Sun.

On the one hand the Veda states that the Sun is all *aapah* and on the other hand it states that the Sun is the governor and controller of *aapah*. In the RigVeda mantra (2/35/14) given below, the Sun being created out of *aapah* is also addressed as *aapah*'s son and the energy that is produced in the Sun is addressed as the Sun's progeny. In this mantra the energy (light) produced by the Sun being two steps removed from the *aapah*, is also addressed as *aapah's naptra* (the grandson of *aapah*). This mantra very beautifully presents the sacrifice of grandparents, which are *aapah*, for their grandson the energy, produced in the Sun. The mantra specifically states that the grandparents are consumed to create the grand children (*aapah's naptra*):

> *"Ever sought out entity, the aapah, with their noble status (as primary devata), otherwise nondestructive in nature, are flowing to dwell into the Sun to annihilate self for the fuel and food of their grandson (solar energy)"* RigVeda (2/35/14).

The solar physics teaches us that the source of energy generation in the Sun is the ongoing Hydrogen nuclear reaction wherein the Hydrogen is continuously consumed. If the word Hydrogen is replaced by the word *aapah*, there is hardly any difference in the two scientific statements on the energy generation in the Sun. Hydrogen by Vedic definition is a higher state of the most fundamental state of matter at *aapah* level. This in fact is presented in the above RigVeda mantra, in a unique poetic way. The additional properties of *aapah* in the mantra are that they are of *noble status* and *otherwise-nondestructive* and that they are continuously *flowing to dwell into the Sun*. This is also not far from our present knowledge of the dynamics within the Sun.

### ***Soorya Rashmi*** (सप्त हरित:)
### - **Seven Colours in the Solar Spectrum**

The Vedic *rishis* have grouped the solar rays into seven colours exactly as is done in the modern society. Yes indeed they are the same seven colours of the solar spectrum that we talk about now in modern science. Not just one or two but there are a large number of mantra references associated with the seven colours in the Sun's spectrum. To highlight this division of the visible part of the Sun's spectrum, a few Vedic terms from two mantras of RigVeda (1/50/8, 9) are first presented. They are respectively: सप्त हरित: (*sapt haritah*) meaning '*seven rays*' and सप्त शुन्ध्युव: (*sapt shundhyuvah*) meaning '*seven rays with cleansing properties*'. The first mention of the 'seven colours of the sunlight' is in the RigVeda where that observation appears a number of times. This author states with conviction that the RigVedic mention of 'seven colours in sunlight'

is the first recorded mention anywhere because, as accepted by most scholars, the book of RigVeda is the oldest text in the human library.

The visible part of the Sun's spectrum discerned with seven colours has become Sun's emblem. When the Sun's emblem is scrutinized from a practical perspective one begins to search for clues that led to the count of the seven colours in the white sunlight. The first clue could be that a Vedic *rishi* looked up at the rainbow in the sky and ascertained that it was a phenomenon arising out of the sunlight. Then the *rishi* arbitrarily divided the rainbow into seven bends and declared that the white sunlight was made up of seven distinct colours. One could also say that the Vedic *rishi* perhaps did not know the mechanism that dispersed the solar rays into the rainbow spectrum. As we know now a rainbow is a light dispersion phenomenon due to the prismatic effect of cloud droplets. This could be experimentally observed in the laboratory by passing white sunlight through a prism. The phenomenon is known as the optical dispersion. One is still tempted to deduct that a Vedic *rishi* in the far antiquity could not have understood the phenomenon of dispersion taking place through the cloud droplets in the sky. There are however all indications in the Vedic Literature that the *rishis* not only engaged in qualitative observation of the rainbow spectrum but also in its quantitative verification. Use of crystals and prisms is an extremely ancient practice in the Vedic society.

Recall a discussion from Chapter 5 where this author had cited Rishi Kapil's *sutra* (1/61) from his Saankhya Darshan, with the expression, "….मणिवत् (*manivat*)" which means "*like a crystal*". Rishi Kapil explained a philosophical thought through the example of a prism (**मणि** = *mani*). Rishi Kapil obviously was familiar with the prismatic action of a crystal, an observation in physical optics. The *yaugik* root-meaning of the term *mani* is – "*an object that concentrates and reveals more than what is obvious*". A quartz crystal is the *sphatik-mani* well-known in the Vedic Literature. A *sphatik-mani* accepts light and re-emits without being affected by the light. Therefore, the *rishis* must have put two and two together when they observed the spectrum in a rain-bow and in the light dispersion by a prism.

The other example of *mani* in a non-optical application is the *ayaskaantam-mani,* which is a magnet. The first term *ayah* in it means iron and *kaantam* means rays or intensity. The action of *ayaskaantam-mani* is to intensify the magnetic rays (lines of force). A magnet creates concentration of the magnetic field which is demonstrated by the alignment of ferrous material (iron filings). Here again the *mani*, a magnetic-prism in this case, is associated with the magnetic field but does not consume it. In the ancient Vedic literature one comes across names of different types of crystals with optical prismatic properties. Without bringing in more examples of prism applications it could be safely said that the Vedic *rishi*'s observation of the seven colours in the sunlight is based on both, the qualitative deduction as well as on the quantitative measurement.

The Vedic *rishis* have assigned an expected term to the phenomenon of the rain-bow. It is called *Indra-dhanush* (Indra's-bow) for it is created by the Sun which is also addressed as the *Indra-devata* (synonym 6 in Table 11.4). In a mantra in the RigVeda (1/146/1), त्रिमूर्ध्दानं सप्त रश्मि: (*tri-murddhaanam sapt-rashmi*) means -'*one who pervades through the triplet with its head of seven rays*'. This means that the Sun with its light in seven colours reaches the triplet. The triplet here could have several meanings: (a) matter at its fundamental state is in a triplet of *sata, raja, tama* and (b) the three divisions of space Earth - solar system - *Dyu*. Thus the 'sunlight's seven rays' is a dominant theme in numerous Vedic expressions that relate to the Sun.

The Veda and the Vedic Literature have gone deeper into the analysis of sunlight by generating nomenclature not only for the Sun's synonyms but also for the solar rays. Such steps are generally taken in a society when the knowledge and on-going research in the subject had surpassed the ordinary stage. Just as in the progress of the modern society the sunlight is first divided into its seven colors and then the other parts of its spectrum are discovered and named, such as the infra-red, the visible and the ultra-violet, the Vedas and the ancient Vedic Literature have also furnished nomenclature for the solar rays in different parts of the Sun's spectrum. Whereas the generic common word for a ray is *rashmi* the RigVeda's (2/12/12) adjective for the Sun, य: सप्त रश्मि: (*yah sapt-rashmi*), means '*one with seven (kinds) rays*'.

The modern physics divides the visible part of the solar spectrum into seven parts based on colours. The seven colours in the order of their appearance in the spectrum are listed in the Table 11.5a. To remember the order of the colours in the spectrum an acronym VIBGYOR is derived using the first letter of each colour.

| **Table 11.5a: Seven colours of** | |
|---|---|

| **the sunlight in Modern Physics** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Violet | Indigo | Blue | Green | Yellow | Orange | Red | Modern acronym: (VIBGYOR) |
| **Seven Vedic Names of solar rays (no relation to VIBGYOR)** | | | | | | | |
| *Sushumnah* | *Harikeshah* | *Vishva-karma* | *Vishva-shrava* | | | | |
| *Sampadvasuh* | *Arvavasuh* | *Svaraat* | | | | | |

The seven names of the solar rays in modern physics represent their colours and not their property or any specific effect that they are known to create. In the Vedic perspective on the Sun the seven solar rays in its visible spectrum are given specific names representing specific meanings (properties). The author has learned that one could go deeper into the subject of solar spectrum and bring out interesting facts, never heard of in modern physics. The discussion here is intentionally kept short. For the sake of novelty, this author chose to list the seven names given to the solar rays of the seven colours by the *rishis* (row 4 and 5 in Table 11.5a). Without a deeper investigation into the ancient Vedic Literature, it is difficult to suggest with certainty that this Vedic division of the solar spectrum into seven parts is in the same order as VIBGYOR of the modern physics or it is different. One could form an equivalent acronym from the above Vedic nomenclature of the division of the visible solar spectrum as: - SHVVSAS. This however is based not on colour but on the property of the rays.

Remarkable here is the number seven being common in the ancient and modern science. If by chance the colours were in the same order in both the science disciplines, the *Sushumna* would be equivalent to Violet. In case the order was reversed the Sushumna ray could be Red. It is quite possible that the property-based Vedic nomenclature for the solar spectrum was derived by the *rishis* owing to some specific physiological effects that these parts of the solar spectrum rendered. It is also possible that there was an entirely different reason for this nomenclature.

It is difficult to relate the depth of study on the solar spectrum by the *rishis* to the study in modern optics. The solar rays in the Vedas are not just the seven named above but many more are named according to their properties. Obviously the *rishis* must have had reasons for creating such a nomenclature. The *rishis* must have observed specific physio-chemical effects of the rays on the Earth in order to give specific names to the parts of the spectrum. If the rishis did not know the specific effect of the specific solar ray why would they choose to give so many names to different parts of the solar spectrum? In addition to many synonyms for the Sun (21 listed in Table 11.4 and more) the 15 synonyms for the word *rashmi* (rays) are listed in the Nighantu (the ancient dictionary of specific Vedic words) which is referred to by Yask Rishi in his Nirukt *sutra*. The rich list of synonyms suggests that the Vedic *rishis* studied and taught the properties of the solar rays in detail, otherwise the synonyms would not have become part of the everyday vocabulary of that ancient society. These 15 synonyms for ***rashmi*** (solar rays) are listed in Table 11.5b:

| **Table 11.5b: Vedic synonyms for the word 'solar ray' (*rashmi*)** | | | |
|---|---|---|---|
| *1. khedayah* | *2. kiranah* | *3. gaaveh* | *4. rashmayeh* |
| *5. abhishaveh* | *6. didhitayah* | *7. gabhastayes* | *8. vanam* |
| *9. usrah* | *10. vasaveh* | *11. marichipah* | *12. Mayukhah* |

| | | | |
|---|---|---|---|
| *13.sapt-rishayh* | *14. saddhyah* | *15. suparnah* | |

In this list of 15 synonyms for the solar rays, except for *vanam,* all are plural words indicating that the solar rays within each name are many in number. The case of *vanam* being singular is mysterious. We know that the solar spectrum extends far below the invisible infrared to far above the invisible ultraviolet and it is in fact a continuum and not just seven distinct rays. One can always define a ray with its specific frequency width, as done in modern optics, and thus have a count of all the solar rays; however, for practical purposes they are innumerable. In addition to the seven main rays of the solar spectrum that are mentioned again and again in the Vedas, the Vedas have also referred to the solar rays as being innumerable, as in the mantra presented above (RigVeda, 10/37/9). The mantra uses the adjective of *hari-keshah* for the Sun, which means '*the Sun's hair being its rays*'. This simile indicates that the sunlight is in a continuum or at least in large spectrum count.

In the context of the solar rays, the RigVeda mantras (10/37/9 and 1/155/6) have addressed the Sun with yet another adjective of *gavo bhuri-shranga*, that this cow is '*with innumerable horns'*. The Sun is addressed as a cow because it has the apparent property of moving. Because the Sun is round (spherical) the implication here is that the innumerable horns of rays are all around it. This mantra may have led sun-worshipping civilizations to depict the Sun as having sharp spikes all around it, as seen generally in some ancient archeological finds.

Now the Vedic references for the planets of the solar system are taken up. The first planet closest to the Sun is Mercury. Its Sanskrit name is *Budha*.

## Mercury: the planet *Budha*

Mercury is the first planet closest to the Sun. Being closest to the Sun it orbits around the Sun on a relatively shorter orbit and therefore it can be seen close to the Sun in twilight periods just before sunrise and soon after sunset. If one looked down from high up over the north pole of the Sun, the Mercury is seen rotating around the Sun in counterclockwise direction like all planets do, with the exception of Venus the second planet. The Mercury completes one revolution around the Sun in 88 Earth-days. Its spin on its own axis is very slow; about once per revolution around the Sun. This makes the planet Mercury to face the same side towards the Sun all the time. All this information on Mercury is based on modern astronomy.

One revolution in its orbit around the Sun and one rotation on its axis is similar to what the Moon does around the Earth. Just as the Earth sees the same side of the Moon the Sun sees the same side of Mercury. Owing to the similarity between Mercury and the Moon, both with low angular momentum around their own axes and presenting the same side to their parent body, some astronomers have hypothesized that in their early stage of formation both were part of the same mass with the heavier part remaining in Mercury, with the average density of 5.427 grams per cubic centimeter and the lighter part forming the Moon with the average density of 3.35 grams per cubic centimeter. One hypothesis is that the Moon was captured by the gravitational attraction of the Earth later in the history of the solar system.

The Vedic name for the planet Mercury is *Budha*. *Budha*, throughout the Vedic Literature, is also the first planet of the solar system. Among the planetary names for the days of the week (Table 11.3), *Budh-vaar* (Wednesday) is named after the planet *Budha* where the suffix *vaar* means the "day". It is quite interesting to note that in the Vedic Literature, including some later Puranas, well before the contemporary hypothesis about Mercury (*Budha*) and Moon having their origin in a common mass of the solar nebula, the planet *Budha* is said to be born out of the Moon. On one hand this is mysterious and on the other hand it is obvious from the planet *Budha*'s synonyms in the Vedic literature that there is some connection between the two planets. This

relationship between Mercury and the Moon is further discussed under the section on the Moon.

All the references on the synonyms for Mercury that relate it to the Moon and the related deductions, even those in the Puranas, precede Western astronomy. Whatever its scientific value, the fact remains that the Vedic thinkers relating the Moon and the planet Mercury in the way similar to the hypothesis of modern astronomers, is mysterious and mind-boggling. It is mind-boggling because the apparently big-looking Moon is seen so close to the Earth while the planet Mercury (*Budha*) is seen like a small dot of illumination so far away, closer to the Sun and which can be observed only for short periods of both twilights, morning as well as evening, and yet the *rishis* deduced that the Mercury and the Moon are related to each other. The close relationship of the Moon and *Budha* (Mercury), with the understanding that the *Budha* was born out of the Moon and not the other way around, is not just mentioned in a fleeting reference but is made very clear in the ancient Sanskrit Literature.

It is also stated in the Vedic Literature that the orbit of *Budha* around the Sun is driven by both the *Vaayu* and *Agni* which respectively are the "force of motion and the heat energy". The Vedic Literature also states that the *Budha* makes a noise similar to the one produced by the clouds in the sky. This is another mind-boggling statement on planet *Budha* because what would lead a *rishi* to propose that the Mercury creates thunderous noise like the clouds in the sky? In conclusion, there are several original features related to the planet *Budha* that are mentioned in the Vedic Literature, some of which coincide with the information from contemporary astronomy while others are mysterious in nature and require further investigation.

## Venus: the planet *Ven* (*Shukra*)

The second planet from the Sun is Venus. In the Babylonian and Roman civilizations it is known as the 'goddess of love'. Its Vedic name is *Ven*. Except for the Sun and the Moon it is the brightest cosmic body in space seen from the Earth. Its orbit is between the orbits of Mercury and the Earth. The planet Venus orbits the Sun in 224.65 Earth days in a retrograde orbit. This means that when viewed from above the north pole of the Sun, Venus is seen orbiting around the Sun in the clockwise direction as opposed to all the other planets rotating counter-clockwise. Venus' rotation around its own axis is very slow and is clockwise as well. Compared to the Earth's daily rotation around its own axis the Venus completes one rotation around its own axis in 243 Earth days. Because the orbit of Venus is between the Sun and the Earth, the Venus going around the Sun comes between the Sun and the Earth and is also seen going to the other side of the Sun. When the Venus is on the far-side of the Sun its disc is seen fully illuminated. When Venus is on either side of the Sun, its disc is seen only partly illuminated and as it changes the position on its orbit the Venus goes through the phase change cycle like the Moon. When it is on the side of the Earth and between the Sun

and the Earth its disc facing the Earth is in darkness and only its rim is seen illuminated.

The planet Venus in the Vedic astronomy and culture is most popularly known by its other name, *Shukra*. The Sanskrit word *shukra* means white, pure, brilliant and several other words with similar meaning. It also means '*a fast moving entity*' (YajurVeda Bhasya of mantra 40/8 by Swami Dayanand). Although the most used name for this planet is *Shukra*, its primary name in RigVeda is *Ven* (pronounced as 'vane'). Among the planetary names for the days of the week (Table 11.3), *Shukra-vaar* is for Friday. The *sukta* 123 of the 10th chapter of RigVeda (10/123/1-8), has eight mantras in it devoted to *Ven*. The 8th mantra of this *sukta* has addressed *Ven* with its other synonym, *Shukra*. There are several other references to *Ven* or *Shukra* in other mantras in other Vedas also. Word-for-word translation of a few mantras on *Ven* is presented and some of its unique characteristics as stated in the Veda are discussed.

Owing to its prominence in the sky and being in the proximity of the Sun, the planet Venus has attracted the attention of past civilizations. Since most of these civilizations are posterior to the Vedas, the name Venus in these civilizations very likely descended from *Ven* in the RigVeda. The difference is that in the Vedas it is treated as a planet while in the Greek and Roman civilizations it has been treated as a mythical goddess of beauty. In addition to its name being *Ven* in the Veda and Venus in other civilizations there are too many coincidences between the Vedic description of this planet and its description found elsewhere.

For the Vedas, all celestial objects - the stars, the Sun and the planets are inert entities. At times their natural beauty has been described with poetic fervour and literary adornments. In the mantra narration of its beauty the Vedas have addressed the planet *Ven* in feminine-gender. In addition to invocation of its beauty the physical phenomena associated with it are also addressed. Whatever the Greek or Latin root for the word 'venus' may have been and whenever it may have originated, the ancient Rishi Yask, a great Vedic etymologist and interpreter of mantras, analyzed the Vedic term *Ven* in his Nirukt *sutra*. It was mentioned earlier several times that the scholars of Sanskrit literature estimate that Rishi Yask lived well before 1900 BCE. In his Nirukt *sutra* (10/4/1), Rishi Yask gives a detailed interpretation of the RigVeda mantra (10/123/1) analyzing its important terms. The term '*ven'* is the 24th word in the list of Nighantu (ancient dictionary of Vedic terms). Rishi Yask states - वेन: वेनते: कान्तिकर्मण: (*'venah' venateh kaanti-karmanah*). This translates into – "*the term 'ven' comes from ven root which stands for beauty"*. The other related meanings of Rishi Yask's term *kaanti* stand for loveliness, brilliance, luster and so on.

In Nirukt (10/4/2) Rishi Yask further deals with the interpretation and analysis of the first mantra of the Ven *sukta* of RigVeda (10/123/1) giving reasons for and the meanings and usage of the important words in the mantra. Without going into the details of his analysis we present the full translation of the mantra in the following.

*अयं वेनश्चोदयत्पृश्निगर्भा ज्योतिर्जरायू रजसो विमाने ।*

*इममपां संगमे सूर्यस्य शिशुं न विप्रा मतिभी रिहन्ति ॥* (RigVeda, 10/123/1)

**Transliteration**:

"*Ayam venashchodayat-prishni-garbhaa jyotirjaraayu rajso vimaane ।*
*Imampaam sangame Sooryasya shishum na vipraa matibhee rihanti ॥*"

**Word transliteration and Translation**:

अयं (*ayam*) = this, वेन (*Ven*) = Venus, चोदयत् (*chodayat*) = enhanced interaction, पृश्निगर्भा: (*prishni-garbhaa*) = in the womb of solar rays, ज्योति: (*jyoti*) = illuminant, जरायु: (*jaraayuh*) = embryonic-sack, रजस: (*rajasah*) = celestial objects , विमाने (*vimaane*) = with flight in space ।

इयम् (*iyam*) = in this Ven, अपां (*apaam*) = aapah, matter in fluidity, संगमे (*sangame*) = meeting place (of rays and or in the space), सूर्यस्य (*Sooryasya*) = Sun's, शिशुं न (*shishum na*) = like an infant/child, विप्रा: (*vipraaha*) = intellectuals, मतिभी: (*matibheeh*) = praised, रिहन्ति (*rihanti*) = affectionate praise specific to a child ॥

**Mantra Translation**:

*"Like a child of the Sun, this (the) Ven, situated in space where objects of matter (cosmos) manifest motion, is seen wrapped in the embryonic-sack of light (jyotir-jaraayu), embedded in the womb of brilliant light rays, enhances the interaction of the Solar rays. This Ven, a 'meeting place' of the Sun (solar rays) and the aapah (matter in fluidity) is praised by those possessing high intellect, like a child is praised by people."* (RigVeda, 10/123/1)

A few comments on the mantra translation are in order. The first two words of the mantra, अयं वेन (*ayam Ven*) are translated as 'this Ven' which may give an impression of 'this *Ven* among other *Vens*'. The fact is that *ayam* emphasizes singularity and uniqueness that this *Ven* is one of a kind. The term *ayam* appears with the Earth and other unique objects as well. The term ayam generally is used for 'uniqueness'.

The author of the eight mantras of this *sukta* is Rishi Bhargava 'ven'. It is obvious from the mantras that he observed *Ven* extensively and what he presented is in the realms of astronomy and physics. He observes *Ven*'s orbital motion around the Sun and observes the varying separation between the Sun and the *Ven*; the orbital motion increasing the separation and then bringing them closer again. Rishi Bhargava 'ven' depicts in his mantra poetry this variation in the contiguity of the separation between the Sun and the *Ven* as an association between a father and a child walking together. Such a poetic expression falls under the poetic adornment called *upma-alankaar*,

meaning the 'poetic adornment with a simile'. The mantra's expression - '*like a child of the Sun'* stems from a common observation in daily life where a child is seen walking in the close proximity of the father, then lagging behind and then catching up with the father, narrowing the gap. A reader of this mantra can never be completely absorbed in the beauty of the poetry alone because the term रजसो विमाने (*rajso vimaane*) for the planet *Ven* pulls him out from the poetic imagination into the arena of astronomy. It states that the *Ven* is in space like the other observable celestial objects of matter (*rajaso*) in flight (*vimaane*).

A straightforward translation of the term '*jyoti-jaraayu*' in the mantra is - '*whose embryonic-sack is light*'. This poetic expression could well be translated as '*thin garment of light*' or '*transparent veil of illumination*'. These expressions enhance the femininity of the planet which has been addressed with several adjectives generally used for the feminine-gender. In a dry physics expression the term '*jyoti-jaraayu*' is - '*its illuminated skin*'. Regarding the expression - *This Ven, a 'meeting place' of the Sun and aapah (matter in fluidity)* means that what is seen as Venus is an interaction between the solar rays and the fluid matter of Venus. When it is put in a cut and dry physics statement it should read as – *the fluid atmosphere of Ven scatters solar rays*.

It was discussed earlier that *aapah* is the term for the most fundamental form of matter from which the Vedic creation begins and reaches its observable form. In the hierarchy of matter-forms the higher degenerate forms of *aapah* are hydrogen and water. Other authors in recent interpretations have translated *aapah* of this mantra to be water. This author has kept the general term *aapah* to represent *Ven*'s atmosphere. The fact as we know it now about Venus is that its atmosphere is predominantly made up of the invisible carbon-dioxide gas and the visible clouds of sulfuric-acid.

The meaning of the expression that people of high intellect praise Venus like people praise a child has also been commented upon by Yask Rishi in his interpretation of this mantra. He says that the term रिहन्ति (*rihanti*) in the mantra represents an expression of affection towards a child. He further elaborates that the primary meaning of *rihanti* is an '*act of licking with affection a newly born*'. The act of licking a newly born is often observed in the animal kingdom. In case of humans expressing affection toward a child the *rihanti* according to Rishi Yask includes '*exaggeration and encouragement*' expressed especially by a mother when she extensively praises her child. In this mantra, however, it is not a child and a mother; they are respectively the planet *Ven* and the intellectuals studying it. The mantra's assertion that the subject of *Ven* relates to intellectuals, means that it is a serious subject for study and learning. At the same time the RigVeda mantra depicting *Ven*'s beauty with femininity may have influenced the Greeks and the Romans in formulating the mythical goddess of beauty, the Venus.

After Ven is addressed as *Shukra* in the 8$^{th}$ mantra of the above mentioned *sukta* of the first Veda (RigVeda, 10/123/8), the second Veda (YajurVeda) has also addressed Venus as *Shukra* in several of its mantras. In YajurVeda (33/33) the term *Ven* is also

used for Venus in "*…rathen Soorya-tvacha | …ayam Venh | chitram devanam*" which translates into:

*"…without aggression, moving close to Sun's tvacha* (touch or skin) *….this Ven is most beautiful among the devas"*. (YajurVeda, 33/33).

The first mantra of the *Ven sukta* of RigVeda (10/123/1) also appears in the YajurVeda (7/16). On the subject of *Ven* the YajurVeda led the Shatpath Brahmana (4/2/1/8, 10) which explicitly equated *Shukra* to *Ven*; both terms being for the same object of astronomy. The mantra reference in the Brahmana is the same as RigVeda's mantra that was discussed above in detail. The Brahmana's emphasis was also on the term *jyotir-jaraayu* (embryonic-sack of light) stating that - *the planet Ven tends to make itself bright like the hot Sun*. Then eons after the Brahmana writings, Rishi Yask in his Nirukt, as presented above, also took up the interpretation of the same mantra with more details. Thus the planet Venus has been a subject of great interest throughout the Vedic Literature.

Now let us look at the next mantra of RigVeda which states:

> *"Born in space this Ven showers the Earth with its urmim (vibrations) through the medium of Space. This sa-yoni, created from the same womb* (i. e. from the Sun) *under the same principle of creation, is glorified by the scholarly who make observations of the back-side (prishtham) of this illumine Ven*." (RigVeda, 10/123/2).

The translation of this mantra was relatively straightforward without requiring too much caution for drawing the implicit meanings of terms. The mantra states that the *Ven* was born in space and is a *sa-yoni,* where *sayoni* is someone '*born of the same womb'*, as in the case of brothers and sisters born of the same mother. Just as the cosmos are said to be *sayoni* from the Mother Nature, the implicit meaning of this word here is for all the objects of the solar system born out of the same solar nebula. The thoughts in this mantra are similar to those in contemporary physics and astronomy. The ancient Rishi Yask, the master of Sanskrit etymology, states in his Nirukt that the word *yoni* originates from the root *'yu mishrne'* to represent '*association and bearing*'. He emphasizes that the term *yoni* therefore is a general term applicable to all three genders (male, female and inert). So, the Sun an inert entity is the *yoni* (womb) of all planets and thus all the planets are *sa-yoni* (siblings). For those appreciative of the Sanskrit language, using the word *sayoni* for *Ven* is a profound statement because it indicates that more than one similar object was born from the same womb. The whole principle of the origin of the solar-system is expressed explicitly in this one word – *sayoni* for all planets.

One other interesting feature of this mantra is that the planet *Ven* showers the Earth with *urmim*. The word *urmim* stands for 'waves' or 'vibrations'. These *urmim* created by *Ven* are said to be transmitted through space and reach the Earth. The most obvious vibrations from *Ven* to the Earth are the sunlight scattered by *Ven*'s atmosphere. But that could be true for Earth's atmosphere scattering sunlight or the atmosphere of Jupiter and Saturn sending the scattered sunlight. The indication in the mantra is that these are the *urmims* (vibrations) with the planet *Ven* uniquely being their source. These *urmims* remain a subject of investigation.

The interesting astronomical feature of *Ven* as described in the mantra is the observation of its *prishtha*m, the "back-side". The Vedic astronomy is very clear on the fact that all planets are three-dimensional bodies with front, back and sides. The backside of Venus is emphasized in this mantra. An observer such as the sage Bhargava 'ven' observed the backside of *Ven* when it was positioned between the Sun and the Earth. The backside (*prishtham*) of a celestial object would get mentioned when it is of high significance as in a Mahabharata *shloka* where the unseen backside of the Moon is mentioned. The *shloka* there stated that even though "… *no human being has seen the backside of the Chandrama (Moon), one cannot conclude from this alone that there is no backside of the Moon..."* The planet Ven goes through its dark phase to its extremely bright phase when it is seen on the far-side of the Sun and closest to it. According to the Brahmana statement (4/2/1/8, 10) cited above – "*the planet Ven tends to make itself bright like the hot Sun*".

Whereas Mahabharata talked about the unseen back of the Moon, the above RigVeda mantra on Ven talks about the seen backside of the planet Venus which according to the mantra happens to be a "*subject of study for the scholarly*". This observation in the mantra, in plain science language of today, could be expressed as – 'when the planet Venus is between the Sun and the Earth, its backside is seen from the Earth with only its rim illuminated and is a subject of investigation by the astronomers'. The planet Venus is observed with its surface covered all the time with clouds and therefore there are no specific surface-features discernible. Consequently, the observations by Rishi Bhargava 'ven' with regard to the back-side of the planet *Ven* in the mantra relate to – "…*Ven showers the Earth with its urmim (vibrations) through the medium of Space*". The *urmim (vibrations)* of the mantra yet unknown could be just the light rays or in particular the lightning flashes in planet *Ven*'s atmosphere that are seen by the astronomers when its disc facing the Earth is in darkness.

The mantras that follow in the *Ven sukta* continue to praise the planet *Ven* where it is addressed as *an object of beauty* '*with garment of rays*' (*gandharva*) situated majestically in '*preferred position*' in space. We do not receive sound waves and noise of thunder from Venus, however, the mantras talk about *Ven*'s mysterious loud echoing sounds (*ghosha*) produced as in 'lightning and thunder' in the Earth's atmosphere. These sound vibrations are another source of *urmim* produced on *Ven*. Its association with *apsara* (lightening) mentioned in the fifth mantra may have something to do with presumptive thunderous sound from the planet *Ven*. Even though it is obvious that

lightening accompanies *ghosha*, the thunderous sound, there is room for further investigation into sound waves generated by *Ven* and their detection on the Earth. The sound does not travel through vacuum and therefore hearing sound waves directly from Venus is not possible. But if the lightening is observed in the atmosphere of Venus, the production of echoing sound (*ghosha)* could be inferred. The contemporary astronomers have observed lightning flashes on the surface of Venus when they become discernible during Venus's dark phase. What is astonishing here is that the Veda mentions the phenomenon of *apsara* on Venus which is lightening!

The lightening produces electromagnetic radiation that is received as noise in the radio and television signals. Therefore, researchers could investigate whether the electromagnetic radiation from Venus is discernible on Earth and whether there is any Amplitude Modulation (AM) or Frequency Modulation (FM) of sound waves occurring in Ven's atmosphere. Did Rishi Bhargava base his description of planet *Ven* on the basis of observational astronomy? Or did he have instrumental measurements to declare that the planet *Ven* created *ghosha*, the noise from the lighting and thunder? Or did he assert that the planet *Ven*'s atmosphere created *ghosha* because he observed lightning flashes on it? Where there is lightning there is thunderous noise. Either way this observational study needed sophisticated instrumentation and at least a powerful telescope. Based on the discussion thus far and the deductions from the Vedas that were labeled by this author as 'mind-boggling', a reader can draw his/her own conclusion on the incredible ability of a Vedic *rishi*.

In the first mantra the Venus and the Sun were compared to a child and a father. In the fifth mantra yet another poetic expression is used for *Ven* where it is a beautiful woman with *sensuous laughter*. This mantra depicts *Ven*'s femininity with poetic acclaim which perhaps found its way into the Western civilizations.

> *"The possessor of aapah (matter in fluidity) the Ven with her apsara (lightening) is also like a woman with beautiful laugh. She receives her beloved, the Sun, and moves through places designated by her beloved. Ven appears with her beloved during her hiranya-paksha, the brilliant phase."* (RigVeda, 10/123/5).

This mantra in fact tells a lot more than just the poetic beauty of *Ven*. It indicates *Ven*'s dominant physical character that it houses *aapah* in abundance. The reference here is for the clouds of Venus because, as mentioned before a number of times, the last degenerate state of *aapah* is water. This is why the water in the ocean is *aapah* and the water in the terrestrial clouds is also *aapah*. The term *apsara* is a conjugate of *ap*, representing *aapah* the water and *sar* representing the action of fast moving. What moves fast in the water of clouds is *apsara* the lightning. We have learned from the modern astronomy that lightning flashes are a feature of Venus' atmosphere. The lightening (*apsara*) is described in the mantra as the smile and *laughter of a beautiful woman (with white teeth)* seeking her beloved, the Sun.

The last line in the mantra translation indicates that this beautiful woman goes into its *hiranya-paksha* when she is close to the Sun. The term *paksh* is for a phase, as in lunar phase. Describing *Ven* with *hiranya-paksha* (bright-phase) indicates the *rishi*'s indulgence in observational astronomy. It is well known that the bright and dark phases of the Moon are termed as two *pakshas* of the Moon, each with duration of about 15 days. The terms for these phases of the Moon are '*shukla-paksha*' (bright-phase) and '*krishn-paksha*' (dark-phase). The literal meaning of the term *paksha*, in dual-plural meaning, indicates the two wings of a bird that enable it to fly. In this mantra the beautiful planet *Ven*, when in its *hiranya-paksha* (bright-phase) is said to be together with her beloved, the Sun. The mantra's adjective *hiranya* for Venus' *paksha* is not just for the ordinary "bright phase", it represents the "brilliant phase".

The other important deduction one draws from this mantra is about the motion of the planet *Ven*. The mantra states that Ven *moves through places designated by her beloved* the Sun. This means that the Rishi of the mantra knew that owing to the Sun the orbit of the planet *Ven* is pre-determined. We know it now that the Sun determines the orbit of all planets.

The other adjectives for the planet *Ven* in the other mantras of the same *sukta* include: '*beautification by light rays'*, '*desirous by heart*', '*the graceful mover in the space*', '*wings of brilliance*', '*an emissary of Varun* (*devata* of waters)', '*the place of yama* (*agni-devata* with deadly heat, the *devata* of death)', '*like a flying bird'*. Of these adjectives '*an emissary of Varun* (*devata* of water)' is mysterious. In common usage the word *Varun-devata* is the "Sun-Earth-Atmosphere-Ocean" system that raises water through evaporation in the form of clouds and brings water down to the Earth in the form of rain. The Vedas have designated the rain cycle as a *devata* (*Varun-devata*) because it is a permanent, selfless, life-sustaining system. Because the root-cause of this system is the Sun, the Sun is also attributed with the virtue of bringing water to the Earth. Therefore, the Sun is the ultimate *Varun devata* (19$^{th}$ synonym in Table 11.4). Since there is no water on Venus as we now know through the observations in modern astronomy the planet *Ven* being '*an emissary of Varun*' remains a mystery. Rishi Bhargava may have addressed *Ven* as an emissary of Varun owing to the cloud-cover of the Venus surface wherein the Rishi observed the *apsara* (lightning).

It is also remarkable that the planet Venus in the Veda is not only described as beautiful but is also termed as the place of *yama*. The term *yama-devata* in common usage is the '*devata* of death'. When one goes beyond the common usage of the word, *yama* is a state of *agni* (energy) that consumes everything. This state of *agni* (energy) is the common fire at high temperature that scorches and destroys substances. This is not too far from the fact that the atmospheric temperature of Venus is at 462 ºC. Such a high temperature on a planet would not support living systems. For a living-being to be on the planet *Ven* means death and therefore it was addressed with the adjective of *yama*.

We will conclude the discussion on *Ven* by presenting the translation of the last mantra of the *Ven sukta*:

> *"Situated high in the sky, desired by the* भानु: (*Bhaanu* = Sun)*, when seen like an eye of the Sun, upon rising in the third 'part of space'* (the place of other cosmos)*, the Shukra creates brilliant and lovely clouds of* द्रप्स: (*drups* = drops)." (RigVeda, 10/123/8).

Among a number of adjectives and similes used for the planet *Shukra* (*Ven*), this *sukta* uses yet another simile that when the planet *Shukra* is very close to भानु: (*Bhaanu* = Sun, 5th synonym Table 11.4) it is like an eye of the Sun. This is when *Shukra* is in its brightest phase situated on the other side of the Earth. This is also the position when *Shukra* is said to be most '*desired by* भानु (*Sun*)'. This is also the 'third part' of the space which in the Vedas is *Dyu*. Obviously the 'second part' of the space is when it is either side of the Sun with half bright-phase and the 'first part' of space is when it is between the Sun and the Earth with its dark-phase. *Shukra*'s "preferred position" is when *Shukra* has the most beautiful display of its lovely brilliance created by the light scattering by liquid drops of its clouds.

The last line of the above mantra translation is as important as physics is when the planet *Ven* is the subject. Notice the mantra's assertion that the "*Shukra creates brilliant and lovely clouds of* द्रप्स: (*drups* = drops)". This is exactly what the modern astronomers have observed from the planet Venus. It is also remarkable that the ancient Sanskrit term द्रप्स: (*drups*) sounds almost the same as the corresponding English term "drops" – suggesting the transfer of linguistic, cultural, scientific knowledge from one place to another.

# *Prithvi*: the planet Earth

The most used Sanskrit term in the Vedas and the Vedic literature for the Earth is पृथवी (*Prithvi*). To show respect for this beautiful inert creation enabling and sustaining life, it is addressed with the adjective of *Maata*, which means the 'mother'. For this reason the Earth in Vedic Literature and Culture is addressed as a feminine entity. A detailed Vedic perspective on the planet Earth is presented in this section. It includes the cosmological, astronomical, physical and geological perspectives.

A brief discussion on the Vedic knowledge about the Earth was presented in the first chapter. Included in that expose were the non-Vedic references of the Greek philosopher Aristotle (384-322 BCE) and the astronomer Ptolemy (87-150 ACE). These prominent Greek philosophers had thought that the Earth was spherical in shape, which it is. They thought that it was the centre of the universe, which it is not. They did not think that the Earth was orbiting around the Sun. The ancient Vedic view on Earth presented in Chapter 1 was based on the Vedic mantra formulations by the Vedic *rishis*, millennia before these Greek philosophers. Not just a few millennia prior to the said Greek philosophers, the Vedic thought emanated millennia before the milestone at February 18, 3102 BCE established in the Chapter 3 for the historicity of the Vedic references.

It was deduced from the Vedic references that '*the Earth is of great size, is a spherical body and it orbits around the Sun*'. Thus, ages ago the Vedas have said for the Earth what exactly the modern science has revealed in recent times. For the sake of continuity and the completeness of the topic, some of the references cited in the Chapter 1 will be brought in here with additional mantra references to show that the Vedas have touched numerous topics pertaining the Earth such as the Earth's early state, its interior, its shape, motions and so on. These areas relate to branches of physics such as – geology, topology and planetary astronomy. Plainly said, this section will present Vedic physics of the Earth.

## Synonyms of *Prithvi* (Earth)

Like the other entities of creation discussed earlier, the subject of Earth is also enriched with Sanskrit vocabulary that reveals properties of the Earth and establishes its relationship with the solar system. Without going into the interpretive details of each name of the Earth, its synonyms straight from the first chapter of Nighantu (an ancient dictionary of Vedic terms), are listed in the Table 11.6a. Yask Rishi in his Nirukt *sutra* (2/2/1) has interpreted the Earth's first synonym, the गो (*go*).

Most commonly used Sanskrit words for the Earth that are found in the Vedic literature and have also descended into the common usage of the different dialects of the Indian subcontinent, are emboldened in the Table 11.6a.

**Table 11.6a: The 21 Sanskrit synonyms of the planet Earth (from Nirukt 2/2, Nighantu's First Chapter)**

| No. | Name | No. | Name | No. | Name | No. | Name |
|---|---|---|---|---|---|---|---|
| 1 | **Gou Go)** | 7 | Kshoni | 13 | Ripa | 19 | Poosha |
| 2 | Gma | 8 | Kshiti | 14 | Aditi | 20 | Gaatu |
| 3 | Jma | 9 | Avanih | 15 | Ila | 21 | Gotra |
| 4 | Kshma | 10 | Urvi | 16 | Nirriti | - | - |
| 5 | Ksha | 11 | **Prithvi** | 17 | **Bhoo** | - | - |
| 6 | Kshama | 12 | **Mahi** | 18 | **Bhoomi** | - | - |

The planet Earth has been addressed in the Vedas and the Vedic Literature with many more adjectives than the 21 listed in Table 11.6a. This author has collected some more from the Veda mantras and has added to that list in Table 11.6b. This richness of the Vedic terminology is unique to the Vedas and the Vedic religion.

**Table 11.6b: Additional terms for the Earth**

| No. | Sanskrit Name of the Earth | Meaning and Reference |
|---|---|---|
| 22 | Vishambhara | Support of all, AtharvaVeda |

| | | |
|---|---|---|
| | | (12/1/6) |
| 23 | Vasudha | Holder of many kinds of wealth |
| 24 | Pratishtha | Firm-support, Terrestrial in nature |
| 25 | Hiranya-vaksha | With gold in its bosom or with golden interior |
| 26 | Indra-rishbha | Accepting Sun's governance, AtharvaVeda (12/1/7) |
| 27 | Bhoori-dhaara | Possessor of various energies, AtharvaVeda (12/1/9) |
| 28 | Bhoo-gol | Earth that is spherical (a common synonym) |
| 29 | Indra-guptam | Guarded by the Sun, AtharvaVeda (12/1/11) |
| 30 | Vardhamaana | One that has increased in physical dimensions, AtharvaVeda (12/1/13) |
| 31 | Dharaa | Base of objects and substances |
| 32 | Vasundhara | One that supports the living beings or one that possesses wealth |
| 33 | Dharati | One that holds all, of terrestrial form |

# Origin of the Earth

For the origin of the Earth let us revisit the AtharvaVeda mantra (9/9/8) on the "Creation of the Solar System". The translation of the part mantra is reproduced here:

> "*Under the* ऋतम (*ritam* = laws of creation), *the mother-Earth was terminally separated* (बभाज = *babhaaj*) *from its progenitor the Sun, because* (हि = *hi*), *earlier* (अग्रे = agre) *it was conjointly together* (सम् जग्मे = *sam jagme) with the Sun*. One *with fluid in its* womb (गर्भरसा = *garbhrasa*) the Earth….." (AtharvaVeda, 9/9/8).

The first sentence of the mantra-translation depicts the cutting off the Earth's umbilical cord from the Sun (metaphorically speaking) and the second sentence stated that the Earth is गर्भरसा (garbh-*rasa*) – one *with fluid in its* womb. This basically presented the principle of the formation of the Earth and additionally the adjectival decoration in the mantra poetry for the Earth was that the Earth was a *garbh-rasa* entity, an entity '*with fluid in its womb*'. The common translation for the term *garbh* is womb; however, its *yaugik* meaning is 'interior'. Therefore a more appropriate translation for the term *garbh-rasa* yields '*the Earth with fluid in its interior'*. The term *rasa* excludes the ground water. Therefore the mantra refers to what we now know as a geological fact that the Earth's interior has molten lava that we see in volcanic eruptions. Observing a volcano is a simple observation but the generalization in the mantra with the added adjective of *garbh-rasa* for the Earth, is a geological deduction**.**

# The Earth in the Vedas is not the Centre of the Universe

The mantra's expression that the Earth was severed from the Sun means that the Sun is a dominant entity and not the Earth. Therefore the Earth could not be the centre of the solar system. Veda mantras in fact

address the Sun as the father and protector of the Earth and express that the Earth's existence is at a subordinate level. With such a clear designation the Vedas would not consider the Earth to be the centre of the universe. More discussion on this will follow.

Under the Vedic creation scenario for the universe, several mantras from the "*Skambha sukta*" of the 10th chapter of AtharvaVeda were cited in Chapter 9. A series of other mantras in the same *sukta* pose questions in a manner posed today in a science classroom. Then in the subsequent mantras the answers to those questions are provided in the same manner as in a continuing lecture on the subject. These questions cover different subjects related to the physical aspect as well as the spiritual aspect of the reality of the universe. In relation to the physical aspect of the universe the questions relate to the energy forms, the *devata* systems of the universe and Time, Space, cosmos, Sun, Earth and the Moon. The AtharvaVeda mantra (10/7/3) asks many questions in one mantra:

> *"In which limb of the created universe stays the Earth, in which limb is the Antariksh (empty Space), in which limb is established the Dyu (brilliant region above the Sun) and in which limb is established the Sun and the region after it?"* (AtharvaVeda , 10/7/3).

The questions basically relate to the region of space carrying the solar-system and its surrounding illuminated region. The answers to these questions come in the 32nd mantra of the same *sukta* where it is stated that if one imagined this region to be in the likeness of a human body, the Earth is at its feet, the intervening *antariksh* (space) is its torso and the Sun occupies its head. In this simile the hierarchy is set between the Earth at the feet and the Sun at the head. The head in a body is the controller and the feet are controlled. Thus the Earth in Vedic thinking is not a central entity and therefore the Vedic creation is not Earth-centric.

## Shape of the Earth

The Vedas have used exquisite adjectives for the Earth. According to the Vedic literature, starting from the oldest book of RigVeda to any five-

thousand year old reference in Sanskrit, the Earth is undoubtedly a round spherical body. This subject was briefly discussed in the Chapter 1. Some of the same references are reproduced here for the completion of this chapter. That the Earth is spherical is cited in the Veda in different mantras in different contexts with different adjectives. A RigVeda mantra (10/58/3) indicating the incredible speed of the Munn-entity (Mind) states that the Munn travels in all four directions on the Earth which slopes down in all four directions. The mantra's relevant first line and the translation is as follows:

यत्ते भूमिम्$_1$ चतुर्भृष्टिं$_2$ मनो जगाम् दूरकम्। (RigVeda, 10/58/3)

**Thansliteration**: "*Yatte bhoomim chaturbhrishtim mano jagaam doorkam*।"

**Mantra Translation:**

"O man! Your *Munn (mind) travels far on the Earth*1 *which slopes down in all four directions*2" (Rig Veda, 10/58/3)

The two important terms are superscripted. The first is भूमिम्$_1$ (*bhoomim*) which means 'the Earth' (18$^{th}$ synonym, Table 11.6a). The second term चतुर्भृष्टिं$_2$ (*chaturbhrishtim*) is the conjugation of two terms, *chatur* and *bhrishtim*. The term *chatur* means 'four' and *bhrishtim* means 'to fall' or 'to drop down'. The composite meaning of the three terms भूमिम्**$_1$** चतुर्भृष्टिं**$_2$** (*bhoomim chaturbhrishtim*) is – '*the Earth which drops down in four directions*' or '*the Earth that slopes in all directions*'. Therefore clearly the Earth for the Vedas is not a flat plate and it instead slopes down in all directions. This is possible for an object when it is round. Need one emphasize more?

In Vedic literature, among the many names of the planet Earth that represent its properties, the most common is *Bhoo* or *Bhoomi* as in the above RigVeda mantra. The other adjective expressing the sphericity of the Earth is *Bhoogol* (*bhoo-gol*). The prefix *bhoo* means the Earth and the adjective *gol* means spherical. Therefore this term means - the "Spherical-Earth". The other adjectives related to the sphericity of the Earth are as following.

The Prithvi *is andaakaara* where *andaakaara* is *aand + aakaar,* which means the "ovate-shaped". This leads to the observation that the Earth is a round 3-dimensional object. It is also addressed as the *chhatra-aakaara*

which means the "umbrella-shaped", curved in all directions like an umbrella. Therefore, the Earth in the Vedic literature has never been a "flat plate". In addition to these adjectives that are associated with the shape of the Earth, the Earth is also called *koorma-prastha-nibhaa* (see Bhagvatdatta). The translation of this compound Sanskrit word in the order of the appearance of the terms is *turtle-back-like*. Similarly, the Earth is also called a *koorma-prashtha* (turtle-posterior). Once again the meaning is- 'shaped like the back of a turtle'. The adjectives related to the back of the turtle convey two properties of the Earth: that its shell is hard like a tortoise-shell and that it slopes down in all directions like the back of a tortoise. These similes are indeed unique and provide a first glimpse in the Vedic physical observation of the Earth. The important fact emerging out of all these terms for the Earth is that their origin is in the far antiquity of the Vedas themselves.

In RigVeda (10/92/5) the Earth is addressed as the (महीम् अरमतिम्) *maheem-armatim*. The word *maheem,* an adjective, is the same as *mahi* (12$^{th}$ synonym, Table 11.6a) which means that the Earth is '*big in size*'. The suffix *armatim* means '*without a container around it*'. This is not just another important Vedic observation about the Earth; it reveals deep science thought about an object that is suspended in space. As it becomes abundantly clear from several mantras that follow, the Earth is not stationary just sitting in one place in space - it is in motion. A common observation about the substances and actions is that generally when a substance is displaced from one point to another the action usually requires a container or a carrier and an actor to execute the action. A container becomes necessary especially when the state of the substance is not solid. With enormous amount of water in the oceans of the Earth one would think that the Earth should need a container around it and that container should be enormous in size. Then one needs enormous power to move the Earth in space. The mantra makes it explicit that the Earth is *maheem* (great) and *armatim* (unsupported by a container) and it moves from one point to the other. The science thought of this mantra is very clear that the Earth is a self-contained object that moves without a container, even with so much water on it. That it moves in space is itself an advanced science thought.

The "Prithvi *sukta*" in the AtharvaVeda is a relatively big *sukta* with 63 mantras in it carrying a lot of information about the Earth. The 60$^{th}$

mantra of this sukta (AtharvaVeda, 12/1/60) stated that - ...अन्त: अर्णवे रजसि प्रविष्टाम्... (*...antah arnave rajasi pravishtaam...*), which translates into - ***'... the Earth that is embedded in Space-entity...'*** It shows that the space is all around the Earth and there is no specific physical container around it to hold it and its oceans and carry it forward.

The expression भूम्या: त्वचम् (*bhoomyah tvachum*) in the RigVeda (10/68/4) means '*Earth's skin*' indicating that the Earth in the Vedas is not a continuous solid blob of matter from its surface to its centre, rather it has a 'skin' that we normally address as the Earth's crust; a geological Vedic observation indeed! If one has good measuring techniques one would find that the human skin is about 1.5 mm to about 4 mm thick depending on the place on the human body. Such a measurement of the skin is relatively easy because the skin sample could be acquired easily. Although the proportion of skin-thickness in a human body is small when compared to the volume of the whole body, nevertheless the skin is needed to hold the body together and to protect it. The skin-thickness for humans varies from 0.2% to about 0.8% of the body thickness. In the case of the Earth, the geological information suggests that the crust of the Earth is about 100 km thick compared to its total thickness of 12,756 km, yielding the crust-thickness about 0.8% of the total thickness which is quite similar to the proportion of the human skin-thickness. The Vedic expression of भूम्या: त्वचम् stating that the Earth has a skin (crust) overrules complete solidity of the Earth. Even in modern times it is difficult to measure with direct means a 100 km thick skin of the Earth, particularly when a large portion of it is covered with water. The mantra reference talking about the skin of the Earth means that the Vedic *rishis* did delve into the subject of geology and its methodology.

## The Earth according to the Vedas has Grown Bigger

When the *devata* of a *sukta* (hymn) is entitled as the "*Prithvi Devata*", it only means that the subject matter of the mantras within that *sukta* is primarily "*Prithvi*", "the Earth". The AtharvaVeda's 1st *sukta* of the 12th *kaandam* (Chapter) with 63 mantras in it is a Prithvi *sukta*. The 18th mantra

of this *sukta* (AtharvaVeda, 12/1/18) states that the Earth has grown bigger from what it used to be in its initial state and that this growth has enabled it to become a place for living-beings. The mantra also states a few other characteristics of the Earth, including its dependent relationship with the Sun. The mantra in its entirety is presented below. The terms representing the Earth's properties are superscripted.

महत्[1] सधस्थं महती[2] बभूविथ महान्[3] वेग[4] एजथु[5]र्वेपथु[6]ष्टे ।
महांस्त्वेन्द्रो[7] रक्षत्यप्रमादम्[8] ।
सा नो भूमे[9] प्र रोचय हिरण्यस्येव संदृशि मा नो द्विक्षत कश्चन ॥
(AtharvaVeda,12/1/18)

**Transliteration:**

"*Mahat*[1] *sadhastham mahatee*[2] *babhoovith mahaan*[3] *veg*[4] *ejathu*[5] *rvepathu*[6] *shte* ।
*Mahaan-stavendro*[7] *rakshatyapramaadam*[8] ।
*Saa no bhoome*[9] *pra rochaya hiranyasyeva sandrishi maa no dvikshat kashchan*" ॥

**Word transliteration and translation**

महत्[1] (*mahat*) = great, big, सधस्थं (*sadhastham*) = habitat for all, महती[2] (*mahatee*) = growing bigger, बभूविथ (*babhoovith*) = have become, महान[3] (*mahaan*) = great , वेग[4] (*veg*) = motion, एजथु[5] (*ejathu*) = to traverse, वेपथु[6] (*vepathushte*) = oscillation/shaking, । महां-स्त्वेन्द्रो[7] (*mahaan-stava-indro*) = even greater the Sun, रक्षत्य (*rakshatya*) = protects you, अप्रमादम्[8] (*apramaadam*) = without neglect or without being lazy।

सा (*saa*) = so you, नो (*no*) = for us, भूमे[9] (*bhoome*) = O Earth, प्र रोचय (*pra-rochaya*) = shine, हिरण्यस्येव (*hiranyasyev*) = like gold, संदृशि (*sandrishi*) = in the likeness of, मा (*maa*) = not, नो (*no*) = with us, द्विक्षत (*dvikshat*) = be jealous, कश्चन (*kashchan*) = no one ॥

Mantra Translation:

> *"O big Earth you have grown bigger and have become the vast habitat for all. Your great*[3] *motion*[4] (महान[3] वेग[4]), *traversal*[5] *(एजथु:*[5]*) and your oscillations/quaking*[6] *(वेपथु:*[6]*) are enormous. The Sun even greater than you* (महां-स्त्वेन्द्रो[7]) *protects you without neglect*[8]*. So, O Earth*[9] *shower blessings of gold brilliance on us and let no one be envious of us."* (AtharvaVeda, 12/1/18).

Grammatical observation of the mantra yields that in the term भूमे[9] (*bhume*[9]) the Earth has been addressed as the 'second person' which translates into 'you Earth'. Therefore whatever is being expressed in this mantra is specific to the Earth. An important feature of this mantra is that the word *mahaan,* which means 'great' or 'extremely big', has occurred four times in differing forms; three times for the Earth and once for the Sun. This is because in the Vedas both these entities are considered to be enormous. The Sun's adjective in the mantra, महां-स्त्वेन्द्रो[7] (*mahaan-stava-indro*), which means '*even greater the Sun*' tells much about the depth of the Vedic science.

The Veda stating that the big Earth has grown bigger from what it was in its beginnings is nothing short of an in-depth physics deduction. It is an outcome of a high level of pre-development in several areas of physics such as global-geography, geophysics, solar planetary physics and astronomy. The geological deduction of the Veda that the Earth has grown bigger than it used to be is no different from the present geological theories which also suggest that the Earth was smaller in size in the beginning. The difference here is that the Veda has revealed this scientific fact in the far antiquity well before the modern geological theories developed for the Earth.

There are two main modern theories for the Earth growing bigger – one is the expansion of the Earth's globe itself and the other is the growth by accretion of extra-terrestrial matter, like falling meteorites and continual bombardment of meteor dust. Yet another theory is that continuous solar energy captured by the biomass becomes part of the Earth. Whatever may be the cause and the mechanism for the Earth's expansion suggested by

modern science, the Vedic observation of the same phenomenon as recorded in the mantra is quite a mystery yet true to the core.

Even if one attributes the mantra's deduction for the Earth's growth from big to bigger creating more terrestrial surface emerging out of the ocean, it would relate to a long-term geological process. Identifying such a process alone and formulating a mantra principle on that is quite remarkable. The mantra clearly states that the actual size of the Earth as a whole has grown bigger with time. It is a well-established geological fact that at one time the Everest and the entire Himalayan region and other high mountains were under the sea and more of the Earth's surface has been thrust out of the sea. It is also a geological deduction that more earth-surface has emerged out of oceans not because the water of the Earth's oceans has evaporated away but because over several billions of years the Earth has grown bigger. This is implicit in the AtharvaVeda mantra cited above. Therefore, the Vedic deduction that the Earth grew bigger and became a '*habitat for all*' is an extraordinary geological observation. The second term in the mantra is 'सधस्थं (*sadhastham*), which means 'a habitat for all to live together' - the vegetation, the animal kingdom and the humans. A full interpretation of the mantra would yield much more than can be brought out in a compact translation.

An important feature of the above mantra (AtharvaVeda, 12/1/18) is that the Sun is the रक्षत्य (*rakshatya*) the protector of the Earth and continues providing an अप्रमादम्ꣳ (*a-pramaadam* = without being lazy, without neglect) protection to it. This shows that the Earth in the Vedas is an entity dependent on the Sun. If the Earth in the mantra is said to be a great entity, its protector the Sun has to be even greater than the Earth. The usage of the term अप्रमादम्ꣳ (*a-pramaadam*) for the Sun, that in taking care of the Earth it does not neglect it, is a significant statement. It is to convey the quality of the relationship between the protector and the protected. A human protector (a father) may neglect the protected (child) but may later resume the protection. The mantra emphasizes that the Sun (protector) never neglects the Earth (protected). The Sun's continued protection of the Earth 'without being lazy' or 'without neglect' means that the relationship between the Sun and the Earth depends on the physical laws that do not alter or fail.

# Three Motions of the Earth

In the AtharvaVeda mantra presented above, three different verbs are used to describe three different motions of the Earth with the common adjective of *mahaan* (महान[3] = great) applied to all three. The verb ***vegah*** **(**वेग**:4)** represents '*forceful motion*' which with the common adjective *mahaan* renders that the Earth moves with *great force*. This is equivalent of saying that the motion of the Earth is with high momentum. Considering that the mantra presents three great motions of the Earth and considering that the meanings of the other two motions mentioned in the mantra, the एजथु:[5] **(*ejathu*)** for motion with 'displacement' and वेपथु:**[6]** **(*vepathu*)** for 'oscillations or quaking', the वेग**:[4]** महान**[3]** (***vegah*** *mahaan*) represents the tremendous 'angular motion' of the Earth under which it spins around its axis. Under the spin of the Earth a point on the equator moving with a linear speed of about 1670 km per hour certainly is a *mahaan* (महान[3]) speed.

The second verb *ejathuh* (एजथु:[5]) is for '*motion with displacement*' as in a walk by a person. Therefore the Veda states that the Earth also traverses with high velocity. This should represent the Earth's orbital speed around the Sun, the Sun being even greater than the Earth. Knowing the Earth's perimeter around the Sun and the time it takes to complete one orbit in one year, one can estimate the Earth's linear motion. We know now that the Earth's estimated *ejathuh mahaan* (एजथु:[5] महान[3]), the "great linear speed", is about 107,220 km per hour in space which of course is *mahaan* (great).

The third movement of the Earth is the *vepathu* (वेपथु:[6]), which translates into - '*motion of shaking*' or '*the motion in oscillations*'. The mantra with the use of the third verb therefore expresses the localized motion of the Earth which is an earthquake. The Sanskrit term for an earthquake is *bhoo-kump* where *bhoo* is a synonym for the Earth as in भूमे[9] (*bhoome*) of the mantra and *kump* stands for oscillations or vibrations or the motion of shaking. All these terms associated with the *vepathu* (वेपथु:[6]) motion relate to lateral displacement around a position. In the mantra the third motion of *vepathu* of the Earth is also associated with the common

adjective of *mahaan* (great) because it is also a motion that cannot be stopped when it occurs and people cannot avoid the resulting devastation.

The AtharvaVeda (12/1/57) mantra 57 of the "*Prithvi Devata*" *sukta* 1 presents a vivid example of the *vepathu* (वेपथु:6) motion of the Earth (earthquake). The pertinent phrase from the mantra is अश्व इव रजो वि दुधुवे (*ashva iva rajo vi dudhuve*). This translates into - *'like the horse shakes off sand (from its body)'*. This engaging simile of the horse shaking off the sand indicates that there is no shortage of proper similes and examples for the *rishis* of the Vedas to describe complex phenomenon for the understanding of the common people.

The three enormous motions of the Earth mentioned in the mantra tell us that the Vedic *rishis*' observations and study of the Earth went beyond the confines of religion. There is no spiritual content in the mantra what so ever, except that the Earth is addressed with affection. Therefore, this is pure Vedic science. The Veda's recognition of the three types of motions pertaining to the Earth tells us in no uncertain terms that the Earth is not a static body but a dynamic entity. This is also made clear by the Vedic terms for the Earth, discussed further in the following.

## Vedic Earth a Dynamic Entity

Researching beyond the three specific motions of the Earth the author has learned from the other mantras that the Earth for the Vedas is a dynamic system. Numerous synonyms for the Earth make it self-evident that the Earth is inherently a moving object. Just a few mantras are presented here with full translation with brief etymological interpretation of important terms. Following is an important RigVeda mantra related to the Earth from its *Vishve-deva sukta*, where the term *Vishve-deva* means 'The Universe'.

या गौ[1]र्वर्तनिं पर्येति निष्कृतं पयो दुहाना व्रतनीरवातर: ।
सा प्रब्रुवाणा वरुणाय दाशुषे देवेभ्यो दाशद्धविषा विवस्वते ॥ (RigVeda, 10/65/6)

**Transliteration:**

*"Yaa gau[1]rvartanim paryeti nishkritam payo duhaanaa vratneervaatarah|*
*Saa prabruvaanaa varunaaya daashushe devebhyo daashaddhvishaa*
*vivasvate||"*

**Word Transliteration and Translation:**

या (*yaa*) = One that is, गौ:[1] (*gou*) = Earth , वर्तनिम् (*vartanim*) = to the path, पर्येति (*paryeti*) = completes, निष्कृतं (*nishkritam*) = well established / well created, पय: (*payah*) = to water, दुहान (*duhaan*) = carrying, व्रतनी: (*vratni*) = producing nourishment, अवातर: (*avaatarah*) = continuous/ nonstop/ repeatedly ।

सा (*sa*) = this/that (Earth), प्रब्रुवाणा (*prabruvaanaa*) = revealing, वरुणाय (*varunaaya*) = of the great one, the Sun, दाशुषे (*daashushe*) = the giver of light, देवेभ्य: (*devebhya*) = for the living beings, दाशत् (*daashat*) = gives life, हविषा (*havisha*) = providing with food and water (vitality), विवस्वते (*vivisvate*) = Sun's power/potency ॥

**Mantra Translation:**

*"The Earth carrying its water repeatedly completes its well established (well-created path). It continually produces nutrition revealing the superiority of the great Sun the giver of light and the bountiful provider of vitality to the living beings".* RigVeda (10/65/6).

The Earth in this mantra is addressed as the ***gou***, the first synonym in Table 11.6a. The list of the Earth's synonyms in the first Chapter of Nighantu, referred to by Rishi Yask in his book of Nirukt (2/2), is one of the most ancient word assemblage of specific Vedic terms. The Sanskrit language reached its final form in the far antiquity of the Vedic civilization. All *dhatus* (word forming roots) in Sanskrit preexist with their grammatical basis in place. When the teaching/learning of Sanskrit started to decline after the great war of Mahabharata about 5,200 years ago, the profound thinker and grammarian Rishi Panini (> 2,900 BCE) wrote the book on the Sanskrit grammar system and word assemblage with analysis entitled

"Ashtadhyaee". Another remarkable scholar Rishi Yask (>1,900 BCE) prepared a treatise on Vedic philology and etymology which prescribes the methodology for interpreting and translating of Veda mantras. His *Sutra*, cited often in this book, is entitled "Nirukt".

With regard to the above mantra, when the Sanskrit grammatical conjugation of words is taken care of, when the context of the subject of the Vedic hymn is kept in mind and the *yaugik* root meanings of the words are utilized according to the framework of "Ashtadhyaee" and Nirukt, the true meaning of the mantra becomes obvious. Following this ancient guideline the RigVeda (10/65/6) mantra translation in English was composed. Let us now analyze the term ***gou*** for Earth in this mantra and in several more to follow.

## The term गौः (*gou*) for Earth

The word "*gou*" in this mantra is in the singular form. The term *yaa* in this mantra or *iyam* in other mantras before ***gou*** is for emphasis. Such emphases in the Veda mantras usually are for distinct entities of the creation. Simply put, the first two words of the mantra, या गौः[1] (*yaa gou*) mean '*this Earth*'. This is equivalent to 'The Earth'. Why the word गौ (*gou*) was created for the Earth becomes clear when one looks into the word formation and interpretation rendered by Rishi Yask in his Nirukt. He stated in Nirukt (2/2/1):

अथ-अतः अनुक्रमिष्यामः। 'गौः' इति पृथिव्या नामधेयम् । यद् दूरं गता भवति। यत् च अस्यां भूतानि गच्छन्ति। गातेर्वा 'ओ' कारो नामकरणः।

अथापि - पशुनाम इह भवति- एतस्माद् – एव । Nirukt (2/2/1)

**Transliteration**

"*Atha-atah anukramishyaamah. 'gou-ah' iti prithivya naamdheyam. Yad tooram gataa bhavati. Yat cha asyaam bhootaani gachchhanti. Gaatervaa 'o' kaaro naamkaranah. Athaapi- pashunaam iha bhavati-etasmaad-eva.*"

With reference to Pundit Sitaram Shastri's Hindi commentary on Nirukt (Niruktam, Parimal Publications, 2005) the above Nirukt statement of Rishi Yask, translated by this author into English, reads thus:

"*The interpretation of 'common usage' is complete and now we will proceed with specific interpretation of words. 'gou'- this is the name of the Earth because 'it has gone far'. And, also because living beings walk on it.*" Nirukt (2/2/1).

*Because it is from the 'gaang' gatau dhaatu (root), it results into 'o' pratyaya -*

*And therefore because of the similar vyutpatti and dhaatu* (etymology and root) *the animal (cow) is also called a gou".* Nirukt (2/2/1)

Starting with the *yaugik* meaning of '*gou*' for the Earth, the property conveyed in the word descends down to its *rurdhi* (ordinary) application for a cow. Rishi Yask's further interpretation in Nirukt (12/1/7), in a different context, states that ther terms '*gou*' or '*gavah*' relate to the term गो (*go*) owing to the property of the verb *gaman* which means '*to have motion*'. Owing to this property several other phenomena are also addressed as गौ: (*gou*). It is the context that determines what the word is used for.

This author is not surprised that a Sanskrit word '*go'* rendering 'forward movement' was adopted in other languages of the West, along with the same pronunciation. The *rudhi* (common) meaning of the word *gou* for a cow, as Nirukt stated in the *sutra* presented above, is because many of its properties are common with those of the Earth. The term *gou* for a cow is not because it has four legs and two horns. It is *gou* because like the Earth it also moves and provides nourishment to humans. The specific movement of a cow that relates to the root of the word 'go' exhibits the cow's movement on its daily grazing circuit. The practices in the Indian countryside have changed now but in the olden days the cows were released in the morning to graze in the pastures. They would go about grazing, unattended and return home in the evening by themselves. In the above mentioned RigVeda mantra (10/65/6), owing to the context in the *sukta* and

the subjects dealt with in the other mantras of this *sukta*, the या गौ1 (*ya gou*) is for the planet Earth.

In this RigVeda mantra (10/65/6) the Earth is said to पर्येति निष्कृतं वर्तनिम् अवातर: (= *paryeti nishkritam vartanim avaatarah*) which translates into "it *completes its well-established, well-created path repeatedly*". A path is well created when it is used repeatedly. The implication is that the Earth follows repeatedly the same stable orbit.

Sitting in home or outside one does not observe that as the clock ticked once to move the seconds needle to the next mark, the Earth has already gone about 30 km on its orbit. This is the *ejathuh mahaan* (एजथु:5 महान3) the "great linear speed" of the Earth and this is the speed that the *rishis* are referring to in these mantras or why would they derive the word "*gou*" for the Earth. This is no ordinary physics!

There are several other important points to note from the mantras presented above.

Now that the root of the term "*go*" or "*gou*" is established, which means the Earth, let us take the next step to reaffirm the Vedic fact that the Earth in the Vedas is in perpetual motion around the Sun. For the amazement of the reader, a full RigVeda mantra (10/189/1) is presented with detailed interpretation.

अयं गौ:1 पृशनिरक्रमीद2 सदन् मातरं3 पुर: । पितरं4 च प्रयं5त्स्व:

RigVeda, 10/189/1)

**Transliteration:** *"Ayam gou1 prishn-r-krameed2-sadan maataram3 puraha| Pitaram4 cha prayan5tsvaha" ||*

**Word Transliteration and Translation:**

अयं (*ayam*) = this (the), गौ:1 (*gou*) = Earth, पृशनि: (*prishnih*) = in space, आ अक्रमीत् 2 (*aa akrameet*) = goes and comes back repeatedly, असदत् (*asadat*) = moves stably, मातरम्3 (*maataram*)= its water, पुर: (*purah*) = localized in place / keeping in the front / holding forward, पितरम्4 (*pitaram*)= the father/the progenitor/the protector, च (*cha*) = and, प्रयन्5 (*prayan*) = movement in an orbit, स्व: (*svah*) = the Sun.

The *devata* (subject) of this 189th *sukta* (section) is 'Earth and Sun'. This means that the mantras of this hymn relate to both, the Earth and the Sun. Therefore, the first conclusion is that this mantra has to do with the 'Earth and Sun' and not a 'cow and Sun'! Even though each word in this mantra is worth interpreting, the interpretation is limited to just a few important superscripted words.

(1) Based on Nirukt etymology the word ***gou*** was analyzed above and it was concluded that ***gou*** is the Earth. Also in this mantra ***gou*** is in singular form with an emphasis on the first word of the mantra, *ayam*, meaning "**The Earth**".

(2) The word आ अक्रमीत् **(*aa a-kram-eet*)** describes the process in which the event happens in a *kram* (not the spelling of the term karma). The word *kram* means 'in sequence' or 'repeatedly'. It is a Vedic term in mechanics representing a controlled repeated motion in an orbit.

(3) मातरम् **(*maataram*)** is water and in the Vedic terminology, the water's association with the Earth is that of the mother and the progeny; the water being the mother and the Earth being the progeny. Water is said to be the mother of the Earth because according to other Vedic references the Earth is "born out of water". This is not too far from the Earth's history as modern geologists theorize today. Initially the Earth was submerged in water and slowly emerged out of the oceans.

(4) पितरम् ***(pitaram*)** represents any of the meanings: the progenitor or the protector or the father. The Sun in this mantra is the *pitara,* the father of the Earth. In the *yaugik* sense of the word the primary meaning of *pitara* is - '*one that gives birth as well as protects*'. Therefore one could draw a conclusion from this mantra that the Sun gave birth to the Earth which came out of the womb of the sea and that the Sun continues to protect the Earth.

(5) प्रयन् **(*prayan*)** is the term for a motion wherein the person (or object) starts at one point, follows a predetermined path and arrives back at the same point and continues the process. In a worldly example of ***prayan*** a devotee goes around a temple 108 times to complete his/her worship routine of *parikrama*. In physics terminology a *prayan* is the motion on a circular

(or elliptical) path which is theorbital motion of an object. The path of the Earth in the previous mantra is said to be निष्कृतं (*nishkritam*). The literal translation of it is a '*well-created path*'. In the context of the mantra a '*well-created path*' is a '*well-established path*' on which the Earth has gone repeatedly. A '*well-created path*' is the one that is well-trodden and free of dangers. It is this निष्कृतं (*nishkritam*) path on which the Earth performs प्रयन् **(*prayan*),** the nonstop motion in a circular and stable orbit.

With these elaborations and the word translations one can now translate the mantra with a slant of modern physics as:

> "*This (the) Earth in Space* (पृशनि: = *prishnih*) *repeatedly goes around in a stable orbit, around its progenitor the Sun, holding its water forward*".
> (RigVeda, 10/189/1).

An interesting observation in this and the previous mantra is the emphasis on the Earth carrying its water with it while it orbits around the Sun. Ordinarily, when water is placed on a solid object in motion in space, the water being fluid is spilt and left behind. Therefore, the mantra answers the latent question- 'If the Earth orbits in space around the Sun would it not leave the water behind?' This remarkable mantra, in just 12 words in the *nichrid-gayatri* meter, expressed a full lesson in physics. This is what is said to be the real power of a mantra. Both meanings of the term पुर: (*purah*) – 'localized in place' and 'holding forward' in space apply for the water on Earth. While the Earth continues to fly in its established orbit with tremendous speed, the water of the oceans is not left behind; it is held in its front and not inside the crust.

The Earth in this and many more mantras, is in space, is never stationary and never considered to be a flat plate. Although these Vedic scientific deductions are on a qualitative level they are as sophisticated as the deductions in contemporary science.

The water and all the objects situated on Earth are carried by it as it आ अक्रमीत् (*aa a-kram-eet*) – repeats its yearly cycle around the Sun. They are held tight by the Earth as it performs प्रयन् (*prayan*) revolution around the

Sun. As we know it now, it is the gravitational field of the Earth that keeps the water, the mountains, all living beings and all substances, tied to the surface of the Earth as it moves at tremendous speed around the Sun and it is the gravitational field of the Sun that keeps the Earth bound to the Sun. The question then is - did the Vedic sages understand that it was the Earth's gravitation that kept all the substances on the Earth tied to it? Yes they did and they expressed this knowledge variously in the mantras. Based on Vedic references let us now discuss the gravitation aspect of the Earth.

## Earth's Gravitation: Veda and Vaisheshik Darshan

In the history of science, Sir Isaak Newton (1642-1727) is credited for discovering the phenomenon of gravitation. Rishi Kanaad (in the distant past of the milestone at February 18, 3102 BCE) in his Vaisheshik Darshan (Vaisheshik Sutra), the second in the chronology of six Vedic Darshans (Table 4.2 in Volume 1), authored by him millennia ago, presented aphorisms on the phenomenon of gravitation. The Vedic term for gravitation is ***gurutva***. It is obvious from his *sutras* (formulations) that the knowledge of *gurutva* existed prior to him in the Vedas from where the term *gurutva* has descended. Of the numerous references in the Vedas and Vedic Philosophy one reference could be cited here from the *Prithvi sukta* of AtharvaVeda. The *devata* of the *sukta* being *Prithvi* (Earth) the mantras from this *sukta* are there to invoke the properties of the Earth. The relevant portion of the AtharvaVeda mantra (12/1/48) states that the Earth is – मल्वं[1] बिभ्रती[2] गुरुभृद्[3] ....पृथिवि[4] …. (*Malvam*[1] *bibhratee*[2] *gurubhrid*[3] …. *Prithvi*[4]…). This translates into,

> "*O Earth*[4] *you possess the terrestrial property* (मल्वं[1]) *to support substances on you and you possess gurutva*[3] *(gravity) the property to attract* (बिभ्रती[2]) *to holding things on you…*"
>
> AtharvaVeda (12/1/48)

Physics as a subject may be dry but at times the mantra poetry makes it extremely beautiful as in the above mantra wherein two different properties of the Earth are pointed out with two adjectives together मल्वं[1] बिभ्रती[2]

(*malvam*[1] *bibhratee*[2]), the first for the terrestrial property to support substances and the second for the property of attraction (gravity), for not letting the substances fly off it. Differentiating these two properties of the Earth by itself is remarkable physics insight by the *rishi*. Both properties are needed to hold the substances on the Earth. If the Earth was a gas-giant like the planet Jupiter it would have the property of बिभ्रती[2] (*bibhratee*[2]) but may not have the property of मल्वं[1] (*malvam*[1]) for things to be supported.

While the Sanskrit term *gurutva*[3] is for 'gravitation' the term *gurubrit*[2] in this mantra is its adjective representing the property of 'gravity'. Obviously the Veda goes much deeper even in dealing with the physical properties of the objects of creation. This and many other Veda mantras led Rishi Kanaad to state in his Vaisheshik Sutra (6/1/1),

"*Buddhi poorva vaakyakritirvede*."

(cited in Chapter 4, Volume 1).

This means: *"The statements in the Veda are sound intellectual creation."*

The Vaisheshik Darshan and all of the other five Vedic Darshans have their roots in the ancient Vedas and Rishi Kanaad's formulations in his Vaisheshik Sutra are the presentations of the Vedic knowledge in the form of aphorisms. We established in Chapter 3 that the Vaisheshik Darshan was written well before Yogiraj Krishna's sermon in Bhagvadgita and the Mahabharata War which ended with the coronation of King Yudhishthir of Delhi, 38 years prior to the onset of the Aryan natural calendar on February 18, 3102 BCE, also established in Chapter 3. The Vedanta Sutra, the last of the six Vedic Darshans was authored by Rishi Vedvyas, a literary giant contemporaneous to Mahabharata and Krishna. Therefore, all of these six books on Vedic Philosophy originated long before Sir Isaac Newton (1642-1727) who is credited for discovering gravitation, *gurutva*, the physics property of mass-mass attraction. References to the phenomenon of gravitation in matter are preserved in the Vedas since antiquity.

Rishi Kanaad did not just make a fleeting mention of *gurutva* in his Vaisheshik Darshan. He explained the phenomenon. He presented three different practical examples that clearly and uniquely delineate how gravitation works and how to understand it under differing situations. Even

though his mathematical formulations on the law of gravitation if any, not available, Rishi Kanaad's three specific examples in his Darshan describe how gravitation acts on objects. The three cases are,

(a) A *moosal* falling vertically under gravity,
(b) An arrow moving horizontally and then falling under gravity and
(c) A rain-drop initially suspended by air and then falling under gravity.

When one carefully studies about a dozen of Vaisheshik Darshan's relevant *sutras* on the subject of *gurutva*, a picture about the abstract concept of gravitation emerges in the reader's mind depicting the unique thought-process of Rishi Kanaad. His deep thinking on the subject and his ability to formulate the related *sutras*, encompassing the association of gravitation with action and motion, reveal his brilliant intellect and amazing teaching style. In the following let us discuss his three examples.

# (A) Moosal Falling Under Gravity

A *moosal* is a hard-wood cylindrical *pestle* about one meter in length and ten centimeter in diameter with a hand grip carved in its middle. It is used for pounding and crushing rice paddy and other grains contained in a narrow wooden (or stone) trough called an *okhal* (mortar) which is about half a meter in diameter and half a meter in height. The usage of a *moosal* requires lifting it up vertically by hand and letting it go vertically down to pound the rice-paddy contained in the *okhal*. Repeated pounding by the *moosal* separates the chaff from the rice.

The Vedic term for an *okhal* (mortar) is *ulookhal* (**उलूखल**). The term has appeared in six of the nine mantras in the 28th *Indra-yagjya-Soma sukta* of the 1st chapter of RigVeda, in the unknown past of Rishi Kanaad. Following the Hindi translation and interpretation by Swami Dayanand Sarasvati, the fourth mantra (1/28/4) states: –

> "*The Indra* (Sun) *uses the strings of force to control like the horses are controlled by ropes. Related to this knowledge is the usage of* **उलूखल** *(ulookhal) the mortar. Learn it and teach it to others with consistency and logic*." (RigVeda, 1/28/4).

The Sun elsewhere in the Veda is said to be controlling the Earth with the "*invisible harness of the Vaayu-devata*", which is the gravitational force expressed in a unique Vedic way. It could be this mantra or the other mantras that inspired Rishi Kanaad to observe the operation of the *moosal* and *okhal* and to observe that the phenomenon of gravity was at work in the process.

In addition to talking about the observed physical process involving the *moosal* and the *okhal*, Rishi Kanaad goes deeper into the mechanics of the seen and unseen processes involving human interaction with gravitation

through the action of the *moosal*. Most would not but Rishi Kanaad saw the science and philosophy at play in the operation of the *moosal-okhal*. He did not limit his thought to just the physical process that enabled the rise of the *moosal* and the other physical process that brought the *moosal* down. He saw that the science was incomplete without the consideration of the human thought that created the interaction between the hand and the *moosal*. The only human contact to the *moosal* was the human hand raising the *moosal*. So he had to consider what and how the action in the human hand of the *moosal*-operator is generated when a *moosal* is lifted against gravity. To differentiate the two forces Rishi Kanaad took this explanation up, one generating upward motion in the *moosal* owing to the hand and the other generating the downward motion in the *moosal* without an obvious force. He began at a fundamental level and stated:

आत्मसंयोगप्रयत्नाभ्यां हस्ते कर्म ।

"*Aatm-sanyog-prayatna-abhyaam haste karma*". (Vaisheshik, 5/1/1).

**Sutra Translation**:

*"Generation of action in a hand is the result of the union of the soul's inspiration and its interaction with the hand"* (Vaisheshik, 5/1/1).

The sequence of events implicit in the *sutra* is obvious that two successive actions are needed to generate physical action in a hand. First is the unseen inspiration in the inner-self (the *aatma,* the soul-entity of the conscious being) and the second is the seen physical interaction that the inspiration generates in the hand to reach out and grip the *moosal*. This inspiration is the *eekshana* force of the consciousness (soul) that, as discussed in Chapter 5, with *visualization, thought* and *desire* create tangible things. The third term *prayatna* in Rishi Kanaad's above *sutra* is the *eekshana* of the soul that generates all actions in a physical body that result into the creation of things by living beings. The two actions according to the *sutra* generate the *karma* in the hand; one at the metaphysical level instructing the hand to do the *karma* and the other at a physical level when the hand grips the *moosal* and raises it. The interaction of consciousness in the process cannot be excluded.

A *karma* is always inspired by a force – either a metaphysical force of the *aatma* (soul) in a living-being or a mechanical force in inert Nature.

Therefore the second term in the *sutra*, *sanyog*, meaning the 'union' is important because no *karma* (action) is possible in isolation. In Rishi Kanaad's example of the *moosal* and *okhal*, a *karma* (action) is not possible without the *sanyog* (union) of at least two entities: the *aatma* (consciousness) and the hand.

For the sake of brevity the next few *sutras* are skipped and only those are included that provide the finer steps in the process of using the *moosal*. The *sutra* (5/1/7) explicitly states that once the *moosal* is lifted up by hand and let go, it is the Earth's gravitation that is the cause for the fall (downward motion) of the *moosal*. This invisible source of karma (action) cannot be discounted.

The next sutra identifies the cause responsible for an action.

संयोगाभावे गुरुत्वात्पतनम् ॥ (Vaisheshik, 5/1/7)

"*Sanyog-abhave* ***gurutvaat****-patnam"*

**Sutra Translation**:

*"Devoid of the sanyog* (union of soul-hand-moosal) *it falls due to* ***gurutva*** *(gravitation)"*.

Because the phenomenon of gravitation was already revealed in the Veda mantras the emergence of Rishi Kanaad's sutras in his Vaisheshik Sutra was not a fortuitous discovery by him. Rishi Kanaad observed gravity's action in the daily life and explained it using the familiar example from the activity in the society of his time. He explained the cause-and-effect and expressed in definite terms that the vertical fall of objects was generated by the force of gravity of the Earth. Notice the term *gurutva* in the above *sutra* - it stands for the gravitational force and only for the gravitational force.

In the *sutras* that followed (5/1/9, 10), Rishi Kanaad introduced two specific terms of mechanics, *nodan-vishesha* and *udsan-vishesha*. Without going into the details of these terms it should suffice here that *nodan-vishesha* (to impel) relates to changing the potential energy of an object by displacing it against a force, the force of gravity in the present context. The *udsan-vishesha* on the other hand represents the specific force that creates **motion** in an object. The example of ***udsan*** is the creation of motion in a stone when it is thrown or the creation of motion in an arrow when it is

shot. Both motions are created by the stored energy (potential energy). It is explicit from the *sutra* (5/1/10) that the *udsan-vishesha* that creates motion in substances is from *nodan-vishesha,* which in modern terminology is the 'potential energy creating kinetic energy'. Simply put, Rishi Kanaad's assertion through *nodan* and *udsan* is that the stored potential energy is converted into kinetic energy – one being the 'cause' and the other the 'effect'.

A general term for a sustained tendency created in an object by *nodan-vishesha* or *udsan-vishesha* is termed as *sanskaar* in that object. The word '*sanyog*' in the aphorism of the Vaisheshik Sutra (5/1/7) cited earlier represents the 'union' of the hand and the *moosal* which can be switched off instantly. However, though *sanskaar* is also created by the union of the imparted force to create motion in an object, it is seen as the object's inherent tendency that lasts till the motion in the object is exhausted. This differentiates *sanyog* from *sanskaar* in that the former is only the association while the latter is the observed tendency in the object itself.

## (B) Arrow Falling Under Gravity

In another *sutra* Rishi Kanaad explains how an arrow moves from one point to the other. The *sutra* states:

इषावयुगपत् संयोगविशेषाः कर्मान्यत्वेहेतुः ॥(Vaisheshik, 5/1/16)

"*Eeshaavyugpat sanyog-visheshaaha karmaanyatvehetuha*".

**Sutra Translation**:

*"Differing successive karma (actions) in the arrow and its union with and separation from each successive locale it*

*occupies, is the cause for the arrow to move forward".* (Vaisheshik, 5/1/16)

To understand the complexity of a *sutra* one needs considerable knowledge of what has been written before and what interpretations have been furnished by the scholarly. To understand a *sutra* the context and the philosophical background are essential. The situation with a *sutra* of a Darshan is no different from understanding a physics principle, example being Sir Isaac Newton's third *sutra* of motion that he put forward in 1686 AD stating "*For every **action** there is an equal and opposite **reaction***", which requires one to be precognizant of the concept and the context of the **action** and the **reaction**.

While a straight-forward tenet such as- '*thou shalt not pollute the environment'* is understood by most people, Newton's third *sutra* of motion is beyond the grasp of common people. The person without some physics knowledge may relate 'action' and 'reaction' in his own personal context. For example, eating of an allergen is an 'action' and the resulting sickness is the 'reaction'. In the spiritual sense the terms 'action' and 'reaction' could justifiably be interpreted as: 'good or bad action' leads to 'good or bad result (reaction)'. In the context of spirituality, Krishna emphasized the equivalence principle of *karma* and its 'result'. Just as some physics background was required to understand Newton's principle, Rishi Kanaad's *sutra* on the motion of an arrow is better understood when one leans on the interpretive commentaries on the *sutras*.

The external action (force) on the arrow, imparted by an archer, at one point in space at a given moment causes the separation between the arrow and that point in space. This separation then causes the association between the arrow and the next point in space. The process continues from the first point to the last when the arrow ceases to exhibit motion. This is the meaning of the *sutra*'s successive union and separation of all points on the flight of the arrow. The action that the *sutra* talks about is the action at one point which is the cause for the separation at that point; separation being the effect. The first action dies and produces the effect, which in turn serves as the action at the next point and so on. Rishi Kanaad has dissected the path of the arrow in infinitesimal points and renewed the action (force) at each point occupied by the arrow.

For this situation a general statement in physics could be framed thus: if no frictional force due to air worked against the motion of the arrow and if the Earth's gravitational-pull was not there to pull the arrow down, the action imparted to the arrow by the archer would make the arrow to keep going continually from one point in space to the next. This in fact is Newton's **first law** of motion that, "*A body at rest remains at rest and a body in uniform motion remains in that state unless an external force is applied to it"*, the external forces being the air resistance (air friction) pointing opposite to the direction of the arrow and the Earth's gravitation pointing vertically down.

The difference between Rishi Kanaad's *sutra* and Newton's first law of motion is that the *sutra* considers a new action at each point on the path of the arrow (a body in Newton's law) to define the position of the arrow at a given time and locale while Newton's emphasis was on the state of a body; at rest or in motion.

The next sutra (5/1/17) by Rishi Kanaad specifically clarifies that the string of the bow imparts the initial *sanskaar* (*sanskaar* = an inherent tendency of an object). This *sanskaar* creates karma (motion) in the arrow, which causes the displacement in its position from the first locale to the next. The inherent force of *sanskaar* produces new karma at the new locale which displaces the arrow to the next locale and so on. The question is, if the *sanskaar,* produced by the string of the bow is inherited by the arrow, why is not the process of karma (displacement) unending and why does the arrow fall down? The answer to this question is provided by Rishi Kanaad in the very next sutra (5/1/18):

संस्काराभावे गुरुत्वात् पतनम् ॥ (Vaisheshik, 5/1/18).
"Sanskaar-abhaave gurutvaat patnam"

**Word transliteration and translation:**

संस्काराभावे (*sanskaar-abhave*) = due to the depletion of *sanskaar*, गुरुत्वात् (***gurutvaat***) = owing to gravitation, पतनम् (*patnam*) = it falls.

**Sutra Translation**:

*"The arrow, in the absence of the sanskaar (inherent force) in it, falls down due to*

*gravitation". (Vaisheshik, 5/1/18).*

From these *sutras* it becomes obvious that the ancient rishis knew what gravitation is and what it does? Rishi Kanaad using the term *sanskaar* for the moving arrow and the term *sanyog* for the *moosal* in the previously discussed example of "Moosal Falling Under Gravity", has the *gurutva* (gravitation) as the common factor in the two *sutras*. The usage of the term *sanskaar* for the moving arrow and the term *sanyog* for the *moosal* is deliberate on the part of Rishi Kanaad, because the two actions are very different. Implicit in Rishi Kanaad's *sutras* is that the arrow on its flight, from the first point in space to the last, exhausts its inherent force, the *sanskaar*, which was produced at the position of the string of the bow. Then why is the arrow not sustained in space till the last point in space? The answer to that is the *sanskaar* of gravity countering the *sanskaar* created by the string of the bow. In the Earth's frame of reference the nature of gravity's *sanskaar* is to create action downwards to make the arrow fall.

This was said by Rishi Kanaad millennia before Newton. The term गुरुत्वात् (*gurutvaat*) in the above sutra tells it all because the meaning of गुरुत्वात् (*gurutvaat*) cannot be anything else but "*owing to gravitation*". Rishi Kanaad's objective in revealing the knowledge of gravitation went beyond the motion of an object falling vertically down, such as an apple from an apple tree or a *moosal* into an *okhal*. Additionally, Rishi Kanaad enlightened the reader with the philosophy behind the falling *moosal* as well, telling us that the initial action is generated by human *eekshana* (desire). Then by taking up the example of the arrow falling under gravity Rishi Kanaad goes one step further to consider a different category of motion under gravity; the horizontal motion of an object. Factually, in the example of the arrow, Rishi Kanaad embodied Newton's first and the third laws of motion. Rishi Kanaad's example of the arrow moving forward due to the force imparted to it by the string and to use this to explain the abstract phenomenon of gravitation is a profound awe-inspiring insight. Rishi Kanaad was fully aware of the hidden force of gravity.

When Rishi Kanaad talked about *gurutva* knowing that the arrow or a *moosal* fell towards the Earth, he did not refer to the gravitation of some unknown and invisible entity. He knew that the gravitation was due to the Earth. He has made this unequivocally clear through several sections of the

fifth chapter of Vaisheshik Darshan where the term *Prithvi* (Earth) is invoked. He points out that the *karma* of *Prithvi*, which is the action of gravitation by the Earth, is in both realms – the visible and the invisible. For the visible *karma* (action) of the Earth he formulates the sutra (5/2/1) using the *nodan* in substances.

नोदनाभिघातात् संयुक्तसंयोगाच्च पृथिव्यां कर्म। (Vaisheshik, 5/2/1)

(*Nodanaabhighaataat sanyuktasanyogaachch Prithivyaam karma*)

**Sutra Translation**

"*The Prithvi's* (Earth's) *karma is seen through association of substances through hard-strike in the nodan* (impelling action)". (Vaisheshik, 5/2/1).

The gist of this *sutra* is that when an object is let go from a height it is impelled (*nodan*) downwards and comes in association with another substance hitting it hard, making it obvious that the process was owing to the *karma* (property) of the Earth. As opposed to substances coming into association of each other owing to the property of gravity in the Earth, Rishi Kanaad presents the next sutra to talk about the invisible *karma* (action) of gravitation:

तद्विशेषेण अदृष्टकारितम् । (Vaisheshik, 5/2/2)

"*tadvisheshen adrishtkaaritam*"

**Sutra Translation:**

" *Different from that* (as in the previous sutra*) is the Earth'sinvisible karma (action)*". (Vaisheshik, 5/2/2).

Rishi Kanaad has exemplified the unseen action of gravity with the rain drops falling under gravity and the water flowing down-ward under gravity. The commentaries on this *sutra* of the Vaisheshik Darshan, by scholarly philosophers in the Vedic Literature (e.g. Acharya Udaya Veer Shastri) have listed other actions of the Earth that relate to the unseen *karma* of the Earth including the spin of the Earth and its revolution around the Sun.

Now let us take up the item (c) listed earlier.

# (C) Rain-drop falling under Gravity

Rishi Kanaad stated in the Vaisheshik sutra (5/2/4) that while "*The flowing of fluids*" is due to the imperceptible (*a-drasha*) karma of the Earth, which is gravitation, he stated in the *sutra* (5/2/5) that the '*Ascent of water* to form clouds in the sky *'is due to the karma of solar-rays in union with the air*'. This not only differentiates between the *karma* of the Earth and the *karma* of the rays of the Sun; it also presents the foundation for the physics of the hydrological (water) cycle on Earth and the cause for the rain - an ancient lesson in physics indeed! Rishi Kanaad goes beyond this lesson in physics and tells us why a rain drop from the cloud will fall to the Earth. Once again he attributes it to gravitation (*gurutva*).

अपां संयोगाभावे गुरुत्वात् पतनम् । (Vaisheshik, 5/2/3).

"Apaam sanyog-abhaave gurutvaat patnam."

**Sutra Translation:**

*"Waters (drops) in the absence of the **union** with air fall down due to **gravitation**"*. (Vaisheshik, 5/2/3)

In this *sutra* Rishi Kanaad has used the term ***sanyog*** (union) the absence of which causes the cloud droplet to fall under gravity. Even though the falling under gravity is common to a raindrop, a *moosal* and an arrow, Rishi Kanaad took up these examples to explain gravity because all three are under differing *modus operandi* - the *moosal* and the arrow relate to the human interaction and the rain drop relates to the natural process. It is the absence of ***sanyog*** (union) between the rain drop and the air that causes it to fall and it is the absence of ***sanyog*** between the human hand and the *moosal* that causes the *moosal* to fall. In the case of an arrow it is the absence of ***sanskaar*** (*inherent tendency*) that causes the arrow to fall. While the *sanyog* is interaction or union with an external substance the *sanskaar* is the tendency within the object itself, the object being the arrow in Rishi Kanaad's example. Using two different terms representing two separate mechanisms that work against gravity, Rishi Kanaad being a philosopher and a scientist, has excelled in going deeper into the physics process than most of us do. It would not be a hyperbole to state that thousands of years

ago Rishi Kanaad used deeper all-encompassing thinking and unique methodology to discuss complex subjects like gravity.

## The terms *Gurutva* and Gravitation

When one looks at the spelling of ***gurutva*** in Sanskrit and **gravity** in the Western languages one cannot help but wonder how in the world the two terms got four letters in common (note the emboldened letters: ***g r t v*** versus **g r v t**)? It suggests that both terms must have a common origin. Additionally, the suffixes 'tva' in Sanskrit and 'ty' in English have the same effect on the word – they lead to forming the noun.

The term *gurutva* in Sanskrit language and in the Vedic culture is as old as the Vedas. While it is difficult to set a date on the origin of the Vedas the term *gurutva* used by Rishi Kanaad, according to Sanskrit literature, precedes thousands of years before the Mahabharata and the beginning of Kali Yuga calendar on February 18, 3102 BCE. This makes the Vedic term very, very old. The term gravitation in the Western languages has come from the Latin *gravitas* for weight. The Latin language itself is said to be not older than a couple of centuries BCE. Therefore, there is no possibility of ancient Sanskrit copying the term *gravitas* from Latin and turning it into *gurutva*. There is however every likelihood of Latin borrowing the term *gurutva* from Sanskrit and turning it into *gravitas*.

It is said that gravitation of the Earth was recognized as a phenomenon in physics by Aristotle (384-322 BCE) and later by Galileo Galilee in the late 16$^{th}$ and early 17$^{th}$ century before Newton (1642-1727) saw the apple fall. Galileo proved from the leaning Tower of Pisa that gravity accelerated all objects at the same rate and also postulated that it was the air resistance that affected the speed of falling objects.

It was in fact Rishi Kanaad, well before all these founding fathers of the modern science, who first said in his Darshan that *gurutva* (gravitation) was the cause for objects to fall on Earth and that it was the *sanyog* (interaction) of the atmospheric air that acted against gravitation enabling the suspension of cloud droplets, which fell when they became heavier against the air resistance to suspend them (Vaisheshik, 5/2/3).

## *Chandrama*: The Moon

यथा हिमवत:[1] पार्श्वे[2] पृष्ठं चन्द्रमसो[3] यथा ।
न दृष्टपूर्वं मनुजैर्न च तन्नस्ति तावता ।।

(Mahabharata, Shanti-parva, 201)

**Transliteration:**"*Yathaa himvatah*[1] *paarshve*[2] *prishtham chandramaso*[3] *yathaa*।

*Na drishtpoorvam manujairn cha tannasti taavataa"* ॥
**Shloka Translation:**

*"Just as the paarshve*[2] *(the backside) of the Himalaya*[1] *is not seen and just as no human being has seen the backside of the Chandrama*[3] *(Moon), one cannot conclude from this alone*

*that there is no backside of the Himalaya or of the Moon*." (Mahabharata, Shanti Parva).

This is a *shloka* from the book of Mahabharata, authored by Rishi Vedvyas and his four disciples, 5,200 years ago. In this *shloka*, the term हिमवत:[1] (*him-vatah*) stands for the Himalaya[1] mountain, the term चन्द्र (*chandra*) in चन्द्रमसो[3] (*chandramaso*) stands for the Moon and the term पार्श्व[2] (*paarshva*) means the 'backside'. It was mentioned in Chapters 3 and 4 that Rishi Vedvyas, in addition to being a philosopher, was an astronomer too and made astronomical observations from the shore of River Sarasvati which went extinct and has been discovered underground in recent times. He had carefully observed both the entities of the above shloka– the enormous Himalaya Mountain and the Moon, to conclude that even though the backsides of both the entities are not seen, both do have their backsides. Astronomers use the term near-side for the front of the Moon and far-side for the backside of the Moon. Rishi Vedvyas has used the most appropriate term *paarshva* in the above *shloka* for the backside. The *shloka* states an observational fact of astronomy, however simple it might be.

Did the author of Mahabharata know some more facts about the Moon? Yes he did and his knowledge of astronomy comes through loud and clear from numerous references in the book of Mahabharata. In the Shanti-parva chapter of Mahabharata (11/12/16) the other *shlokas* refer to the lunar-phase changes and the Moon being the cause for the tides in the otherwise calm ocean, stated as - "*Yatha chandrodayo ddhootah kshubhitah saagaro bhavet"* (Mahabharata, Dron Parva 7/35/29). Also in "*Yatha chandro hyamavasya…*" – "*the Moon is absent and not seen in the sky owing to the Moont losing its lingam* (recognizing feature) *and it is absent not because it is destroyed…*" and in "*Ksheenkoshe hyamaavasya… yatha koshanteram… Chandrama bhrajate punah*". This means – "*…the Moon being in the diminutive raashi (constellation sign) with respect to the Sun it does not exhibit its illumination and it is lit up again as soon as it enters the next raashi*." All such statements in the book of Mahabharata are in the realm of physics and astronomy.

The Vedas have devoted a significant number of mantras to the Moon and to the different subjects related to it. The commentary books on the Vedas - the Brahmanas, Samhitas, Nirukts and Puranas have also added

considerably to the subject of the Moon. The deductions in some of these ancient books may differ from the present knowledge; however, many deductions are extremely close to the current knowledge of the Moon, an entity not accessible directly and physically to the earthlings.

The differences between the ancient Vedic thought and the modern discoveries related to the Moon are certainly in different styles of thought, yet some similarities between the two are quite uncanny in spite of the large time-gap between the ancient Vedic period and the modern times. Undoubtedly the thought process of the *rishis* is much deeper than what one observes in the modern science discipline. Take for instance the meaning of the word *chandrama*, one of the synonyms for the Moon. The word *chandrama* appears in several Veda mantras. Yask Rishi in his Nirukt (11/1/5, 6) etimology took up two RigVeda mantras (10/85/5, 10/85/19) on the Moon that respectively relate to the etymology of the word *chandrama* and the Moon's basic physical property that it renews itself successively through its bright phase every month during the first fifteen days of the month and thus takes part in establishing the *samvatsar* (the time-cycle defining the month and the year). Rishi Yask states that the term *chandra* (or *chandrama*) is formed from at least four roots; all represented in the single term *chandra* reflecting the properties of the roots. This author presents one root here.

The term चन्द्र **(*Chandra*)** for the Moon is formed from the first syllables of the two verbs चायन् (*chaayan*) and द्रमण (*draman*) which respectively are for '*to look*' and '*to move*'. Rishi Yask then elaborates further. The Moon is Chandra because it is चायन् द्रमति **(*chaayan dramati*)** meaning – '*one that moves glancing all*'. The Moon moves in the sky and it also "looks" at all substances that it illuminates. The formation of this term for the Moon seems easy and straightforward, however a physics perspective of the Moon shows that it is extremely smart.

If an onlooker keeps looking at an object while walking the onlooker has to keep turning his face towards that object. That is what the Moon does while moving in the sky. On a full-Moon night for example, when the Moon rises above the eastern horizon its same face looks towards all objects on the Earth. As the Moon moves traversing the sky till it sets in the west, all objects/observers on the Earth see the same face of the Moon. This is Chandrama's (Moon's) *chaayan dramati*, a unique property. From the

elementary astronomy we know that the Moon is '*moving while glancing all'* because it spins around its own axis exactly once when it completes a revolution around the Earth, thus keeping the same face towards the Earth. This whole physics lesson about Moon's *chaayan dramati* is hidden in the Vedic nomenclature for the *chandra*. This is why the author has emphasized several times that the word formation in the Vedas is remarkable. That is why Rishi Kanaad stated in the Vaisheshik Sutra (6/1/1), *"The sentence composition in the Veda is a sound intellectual creation"*.

One might say - what is so special about the Moon when the Sun is also a *चायन् द्रमति* (*chaayan dramati*), '*moves glancing all*'? Strictly speaking the Sun is not a "chaayan dramati".

The Sun also illuminates objects and "sees" them all as it moves in the sky. However, the physics fact is that as the Sun moves through the sky its same face does not 'see' an observer on the Earth. This is because unlike the Moon the Sun rotates around its own axis while seen moving through the sky. A point on its equator completes one spin of 360º in 26.47 days which is about 7º in one day-time (morning to evening). If the Sun had two eyes like we do and glanced at an observer on the Earth at sunrise, its eyes would have shift through a 7º angle away from the observer by the time it sets. This is equivalent to the 'Sun is looking at someone else' and therefore it is not a *chaayan dramati* like the Moon. Moreover, as opposed to the solid crust of the Moon, the Sun being a gaseous body, it spins with different rates at its different latitudes. Also, the Sunspots on its surface keep changing with time. In short, the Sun's face keeps changing continuously as it moves through the sky. Therefore, '*one that moves glancing all*' applies uniquely to the Moon. This is why the Moon is the *चायन् द्रमति* (*chaayan dramati*), the *चन्द्र* (Chandra). A remarkable observation by the rishis indeed!

The Moon has numerous synonyms owing to the numerous properties it exhibits. In the RigVeda mantra (1/105/18), interpreted by Rishi Yask in his Nirukt, the Moon is अरुण (*Arun*) because it is '*arochanah*', meaning - "*it illuminates the world with its light*". The Moon is मासकृत् (*maas-krit*) because "*it is the creator of the month and the half-month*". The Moon is वृक (Vrik) because "*it moves under the nakshatras* (stars/constellations) *and shows its definite path through the constellations and it exhibits its daily*

*association with a constellation that it rises with*" (see Nirukt, 5/4/1, 2). Nirukt states that for this reason the Sun is also addressed as a वृक (Vrik).

The other popular synonym for the Moon is Som (सोम). The Moon is Som owing to the its early history when it was created. The book of Shatpath Brahmana (1/6/3/17, 24) states that when the ring of matter, the *vritra* surrounding the Earth, was broken in two parts (discussed below under 'Origin of the Moon'), the Moon was formed out of the part that favoured the *Som* property on Earth. In Chapter 8 a term '*Som-devata'*, was introduced to represent one of the seven progeny of *Aditi* (Nature). In that reference the *Som-devata* represented the chemical energy of the universe. This energy is a *devata* because without it the biological systems could not survive in the creation. This is the energy flowing through the chemical bond in the vegetation and all living forms. The vegetation world in the Vedas is addressed as the *vanaspati* (vegetation) and *aushadh* (medicinal herbs). It is a firm belief in the ancient Ayurvedic Medicine system that the Moon-light plays a vital role in creating and enhancing the medicinal properties of the vegetation (herbs). The vitality in the herbs is therefore known as the '*som*'. The Vedic references also state that the Sun's *Sushumna* spectrum reflected from the Moon enhances the vitality of the *aushadh* (medicinal herbs). This is one reason that the Moon acquired its synonym Som.

The term *som-rasa* is quite well-known as an ancient drink of the Aryans. Owing to some incompetent Veda translations, the present-day myth is that the *som-rasa* is an intoxicating drink. It is outside the scope of this book to invoke the mantra references and prove that the *som-rasa* is a power-enhancing fresh, non-toxic juice-extract of an herb called '*som-lata*', where the term *lata* stands for a vine. The reason for *som* being the name for a vine is not ordinary either. This vine not only produced a juice with vitality but it has a unique relationship with the Moon. The description of the *som-lata* in the Vedic Literature highlights a property of the vine that has relevance to this section of the book.

Som-lata the vine, like Som the Moon, is also a मासकृत् (*maas-krit*) – "*the creator of the month and the half-month*". The amazing property of this vine is said to be its synchronization with the lunar phase in leaf growth and leaf shedding. When the bright lunar phase begins on the new-moon the *som-lata* sprouts one leaf and every day from there on it puts out one leaf

such that by the end of the bright-phase of the Moon, at full-moon, it grows a total of 15 leaves. Then during the dark lunar phase it begins to shed one leaf every day and in 15 days it becomes a leaf-less vine. Thus like the Moon, the *som-lata* also is a living calendar, recording half-month and month and helps in counting the 12 months to create the *samvatsar.* The Moon and the Sun of course are known as the *samvatsar* creators.

A Vedic student, like this author, at times is caught with unexpected surprises. Yask Rishi in his Nirukt (2/2/2) refers to two RigVeda mantras and includes the relevant part of the YajurVeda mantra (18/40) which renders a brilliant example of an unexpected revelation. The scientific fact stated in this mantra was as true when the Veda was composed as it is today. In this universality of Vedic knowledge, the Moon is lit by the solar rays and the Vedic *rishis* were unambiguously cognizant of this fact. The relevant part of the mantra is:

सुषुम्ण: सूर्यरश्मिश्चन्द्रमा गन्धर्व: ....(YajurVeda, 18/40)

**Transliteration**: *"Sushumnah Soorya-rashmih Chandrama gandharvah…"*

**Mantra Translation:**

*"The Moon is gandharva* (*one having the garment made of solar spectrum*) *owing to the sushumna rays of the Sun on the Moon…."* (YajurVeda, 18/40)

Two words in this part-mantra that provide a qualitative definition of the Moon are *sushumna* and *gandharva*. *Sushumna* is an adjective for a particular part of the solar spectrum that creates tranquility in the human mind. Among the seven Vedic names of the solar rays in the solar spectrum that were listed in Table 11.5a under the sub-heading of "Solar Rays: *Soorya Rashmi*", the group of *Sushumna* rays were listed as the first. One straightforward conclusion here is that because the *Sushumna* rays are generated by the Sun and they are said to be on the Moon, the Moon is illuminated by the Sun. Of course the entire solar spectrum falls on the Moon but what is dominantly reflected towards the Earth is said to be the *Sushumna* part of the spectrum. Rishi Yask in Nirukt (2/2/2) has taken up this mantra and given considerable insight into what illuminated what.

The term *gandharva* is an adjective-noun formed with the two conjoined words; the first part stands for '*solar rays*' and the second for '*wearer of*' in the same sense as a person wearing a garment. When the root for the word-formation is examined one gets a deeper understanding of the term *gandharva*. The property of a garment is that it is external, secondary and a non-permanent associate of a body that it covers. Just as a garment changes the look of a person, the *Sushumna* rays of the Sun also change the *Chandrama* (Moon) into a *gandharva*. The adjective of *gandharva*, the '*wearer of the garment of solar-rays*' for the Moon is to indicate that *Sushumna* rays from the Sun that are reflected from the Moon are not the Moon's own and are just its exterior garment. Therefore, cogitating upon the meaning of the terms and not finding an equivalent single word in English for *gandharva*, the author translated it to read - '*one having the garment of' solar spectrum'*. In the same mantra the *Sushumna* are clearly said to be *Soorya*'s *rashmi* (Sun's rays), which makes the fact abundantly clear that the Moon is not a *jyotishkrit* (self-effulgent), a term used for the Sun and discussed earlier under the sub-heading of "*Aapah* the Fuel of the Sun".

The fact that the Moon is a part of the Sun-Earth system and that it is illuminated by the sunlight and repeatedly runs on its orbital path tied to the Earth and it goes around the Sun as the Earth revolves around the Sun. This is very clearly stated in a mantra of the RigVeda (1/105/1). The first line of the mantra states - "*The Moon within* रोदसि (*Rodasi*), *illuminated by* दिवि (*divi*), it आ धावते (*aa dhaavate*)…" The term *Rodasi* defined in the beginning of this chapter stands for "*the region of space for the Sun-Earth system*", the term दिवि (*divi*) means the Sun -the illuminator or '*under the light of the Sun*' and आ धावते (*aa dhaavate*) means "*runs repeatedly well (in perfection)*".Therefore, the composite translation of this RigVeda phrase for the Moon is –

" *The Moon is illuminated by the Sun, confined within the Rodasi space of the Sun-Earth system and runs repeatedly well (in perfection)*".

Compared to the common expression - 'the Moon moves in its orbit', the expression आ धावते (*aa dhaavate*) in the RigVeda mantra for "*the Moon runs well repeatedly*" is indicative of the fact that the orbital period of the Moon is faster than Earth's and the other objects.

The fact that the Moon is illuminated by the solar rays is stated in the Veda not just once, but many times in differing contexts. Let us invoke Rishi Yask's Nirukt (4/3/4/1) here which gives the interpretation of the RigVeda mantra:

अत्राह गोरमन्वत नाम त्वष्टुरपीच्यम् । इत्था चन्द्रमसो गृहे ॥

(*Atraah gormanvat naam tvashturpeechyam । Itthaa chandramaso grihe*) ॥ RigVeda Samhita, 1/6/7/15).

Yask Rishi researched the properties of the lunar rays and explained in Nirukt the interpretation of the mantra. He stated:

"*The Sun's rays go to the Moon and shine from there, and their properties are apeechyam, apchitam, apgatam, apihitam and antarhitam" – all this takes place on Chandrama's griha (surface)".*

The term *apeecham* assigns an adjective to the special group of rays called *sushumna*. The Sanskrit term *apeecham* is for 'constricted' or 'narrowed'. Rishi Yask further comments that the rays reaching the Moon are of four differing labels (properties) – (1) *apchitam (apeecham)*: one that separates from the Sun and attaches to the Moon, (2) *apgatam*: one that has gone (cannot return), reflected away, (3) *apihitam*: one that is established there and covers and (4) *antarhitam*: one that has penetrated inside (absorbed). When these four properties of the *sushumna* rays of the Sun are analyzed and interpreted from the physics perspective and expressed in modern physics terminology one learns that the property of (1) *apchitam* puts these rays in the category 'of extra-lunar origin' which have reached the Moon from elsewhere. The Veda of course makes it clear that the origin of these rays is the Sun. The (2) *apgatam* the 'one that has gone' means that there is no back and forth exchange of the *sushumna* rays between the Sun and the Moon – these rays have gone from the Sun for good. The property of (3) *apihitam* indicates that these rays cover the entire lunar disc and do

not provide selective illumination of only some parts of the object. The last property of (4) *antarhitam* represents the fact that these rays are not just received by the Moon and reflected away but they are absorbed in the lunar surface and then re-emitted. With these details about the *sushumna* rays of the Sun on the Moon it becomes obvious that the *rishis* have explored the solar spectrum on the Moon in their own unique way and have classified the solar spectrum in a different way that we do not quite understand at the present time.

The important fact which enlightens our intellect is that the solar rays that illuminated the Moon were absorbed in it and reemitted; a common process in light reflection. It is for this part of the solar spectrum that the *rishis* give the adjective of *gandharva* to the Moon - *one having the garment made of solar spectrum*.

Excepting the Sun, all objects in the solar system, big and small including those on the Earth, including the Earth, reflect sunlight. Are they all *gandharva*? Logically yes, but the term in Vedic practice is for an entity of importance with its presence in space, like the Moon. By the same token all planets are *gandharva*.

There are five successive mantras on the Moon in AtharvaVeda (14/1/1-5). The translation of just the first mantra stating what supported what and what illuminated what is yet another example in Vedic physics, expressed in mantra poetry. It states:

> *"The laws of creation and physical laws (ritam and satyam) hold all in perfection. The Earth in space and the illuminated region (Dyu) surrounding the Sun exist in perfection owing to the Sun. Owing to the said laws, all those aadityaha born of the Sun (objects of solar system) exist in perfection and the Moon owing to the sunlight (divi) is perfectly adorned.* AtharvaVeda(14/1/1).

The knowledge in these Vedic mantras is an unusual gift of physics to humans. For the Vedas it is yet another natural phenomenon that the Moon is being illuminated by the Sun and a Vedic reader should enhance his knowledge!

The mantras from the Vedas and statements from the ancient Vedic Literature also shed some light on the origin of the Moon. They go beyond

just the origin of the Moon; they cover some aspects of its surface morphology, its role in time-keeping and its benefit to living beings on the Earth. These Vedic deductions are in statement form without any evidence of mathematical or observational support, yet they are very intriguing.

One wonders whether there was rigorous mathematical treatment and observational astronomy behind the Vedic deductions. An example of this in the Vedic thought is the explanation of the origin of the extended dark plains on the lunar surface called maria (Latin for seas, singular being mare). The Vedic perspective on maria regions of the Moon is expressed in different references. Interesting enough, this Vedic perspective is quite similar to some of the hypotheses by modern astronomers. The discussion on the Vedic perspective on the origin of the Moon and some deductions that relate to the lunar observations made by the *rishis* eons ago are in the following. These certainly relate to the contemporary scientific deductions about the Moon.

## Vedic Origin of the Moon

Analysis of the Apollo lunar samples suggest that the Moon was formed about 4.527 ± 0.010 BY ago, some 30 to 50 MY after the formation of the solar system. The only natural satellite of the Earth, the Moon completes one orbit around the Earth in about 27.321 days and rotates once on its own axis in the same time showing always the same side to the Earth. Its radius is about 27 % of the Earth's but it weighs only a bit more than 1% of the Earth's weight. It reflects about 12% of the light it receives from the Sun, compared to about 30% reflected by the Earth. As stated earlier, the Moon in Vedic terminology is not a *jyotishkrit* (self-illume) entity like the Sun.

There are about four modern hypotheses for the origin of the Moon. This author has added a fifth to the list - the '**Vedic View of the Creation of the Moon'**.

**(1) The Fission Hypothesis**: It suggests that the Earth's rotation on its own axis created enough centrifugal force to separate the mass of the Moon from the Earth's crust leaving behind the Pacific Ocean basin that got filled with water as time progressed. This idea would require the fulfilling of two requirements - the Earth being in high spin and the Moon orbiting in the Earth's equatorial plane. Neither of these two fit into the puzzle.

**(2) The Capture Hypothesis**: It suggests that the Moon was formed elsewhere in the solar system and was captured by the Earth's gravitational pull later in the life of the solar system. The gravitational capture of this magnitude would generate extremely high levels of heat in the Earth's crust and in the Earth's atmosphere. The astronomers feel that the Earth's atmosphere is not big enough to dissipate the generated heat. Therefore, the capture hypothesis is not accepted by the astronomers. Further discussion on this hypothesis is taken up later.

**(3) Co-formation Hypothesis**: This hypothesis is the same as that for the entire solar system where the Sun and all planets are created simultaneously from the same disc of matter. The Moon was created from the rotating disc of matter that was for the Earth. The Moon accreted out of the outer part of the disc and the Earth from the inner part, at the same time and right in the same orbital course of the Earth. The astronomers and lunar physicists find this hypothesis inadequate because it does not explain the deficiency of metallic iron in the lunar samples. The density of the Moon is only 3.35 gram per cubic centimeter compared to the Earth's 5.515 gram per cubic centimeter.

None of these hypotheses can explain how the Earth-Moon system acquired high angular momentum. The fourth hypothesis, which sounds far-fetched but seems most acceptable to the astronomers, is as follows.

**(4) Giant-impact Hypothesis**: According to this hypothesis a Mars-sized body with its hypothetical name Theia impacted the proto-Earth. This impact blasted off enough material into the orbit around the Earth to form the Moon through the accretion process. The computer simulations work well for this hypothesis and one can even generate the required angular momentum for the Earth-Moon system by distributing Theia's mass and momentum between the Earth and the Moon. But the

hypothesis is not able to tell what proportions of masses were involved and what proportions of Theia were absorbed to form the Earth and the Moon. Surprisingly the oxygen isotope composition of the Moon and the Earth are found to be the same. This poses an unanswerable question - why would a giant impact by an extra-terrestrial body like the hypothetical Theia lead to a similar oxygen isotope composition in the two separated bodies, the Earth and the Moon?

These four hypotheses put forward by astronomers will remain hypotheses till solid proof of one against the others becomes available. Before that they all remain in the category of 'speculations in science'. It is also possible that none of these four will survive and a new hypothesis could emerge. The fifth hypothesis is added here by this author that is based on the science information in the Vedic Literature. The Vedic hypothesis has some features that are common with the "Capture Hypothesis" listed above.

**(5) Vedic View of the Creation of the Moon**: The Sun, in the hierarchy of the creation of the universe, is considered to be a secondary-*devata* and is addressed with numerous names based on its properties, the *Indra-devata* (see synonym 6 in Table 11.4) being a prominent one. In the context of the Earth and the living creation on it, the Sun is the *Indra* because it brings rain through the rain-cycle by providing light and heat to the Earth and its atmosphere.

Related to the early history of the solar system are mantras that invoke *Indra-devata* the Sun, for having cleared the space surrounding the Earth from a specific ring of matter that had '*encircled the entire Earth blocking all sunlight and making life impossible on it.*' The Vedic term for this ring of matter is *Vritra*. The meaning of the term '*vritra*' is a 'circle'. The Veda mantras present a clear statement to the effect that to sustain life on Earth; the sunlight struggled hard to penetrate the ominous ring of matter called *Vritra*. What was an atmospheric physics observation regarding the early history of the Earth, recorded in the Veda mantras, was turned by the Puranic writers into a well-popularized Puranic Hindu myth of the *Indra-Vrittasur* battle. The term *vrittasur* is formed by two words – *vritra* (ring) and *asur* (demon).

The Puranic mythological development is relatively recent between 500 BCE to 500 ACE when Puranas were written. The misinterpretation of

the Veda mantras has led to numerous other Puranic Hindu mythological stories. In the narrative of the *Indra-Vritra* mythology a pitched battle between the *Indra-devata* the ruler of the skies and the anti-life *Vritra*-demon took place. The *Indra* used his weapon of *vajra* (electricity/lightening) to destroy the anti-life *Vritra*-demon who ultimately was broken into two pieces.

*Vritra* the ring of matter cleared from the skies, the light reached the Earth and ultimately enabled life on it. This is what is said in the Veda mantras which have no mythology in them. By taking the mythology out of the Puranic description of the same event in the early history of the Earth and knowing that the source of the story was a set of Veda mantras, one gets considerable insight into the early physics (geology) of the Earth and its atmosphere. The non-mythological mantra references of the *Vritra* appear in a large number of Veda mantras with differing contexts. For brevity no such mantras are cited here and the subject of the creation of the Moon is emphasized instead. The process of interaction between the sunlight and the dispersed matter around the early Earth forms the basis for the Vedic scenario for the creation of the Moon. This is presented below.

Instead of some mantras on the *Vritra* and Indra (Sun) the author chose to present a descriptive narration of the process for the creation of the Moon from the book of Shatpath Brahmana on YajurVeda authored by Rishi Maadhyandin that predates the historical Milestone at February 18, 3102 BCE. The starting step for the formation of the Moon lies in the ring of matter around the Earth called the *Vritra*. Rishi Maadhyandin narrates:

> सोऽअकामयत । भूय एव स्यात्प्रजायेतेति स आदित्येन[1] दिवं[2] मिथुनँ[3]समभवत्तत आण्डँ[4] सम वर्तत तदभ्यमृशहेतो बिभृहीति ततश्चन्द्रमा[5] असृज्यतैष वै रेत[6]: । Shatpath Brahmana (6/1/2/4).

**Transliteration:**

> "*Soakaamyat । bhooya eva syatprajaayeteti sa aadityen*[1] *divam*[2] *mithunam*[3] *sambhavattat aandam*[4] *sam vartat tadabhyamrishheto bibhriheeti tatashchandrama*[5] *asrijyataish vai retah*[6] ।।"

**Translation:**

> "*He (the Creator) desired, that this Aditya[1] (Sun) be grown larger, to increase its population. He made it to mithun[3] (interaction for procreation) with the Divam[2]. This interaction resulted in an aandam[4], the ovate. To that, He gave a powerful touch and made it to bear the earthly[6] state of matter. Created from that was the Chandrama[5] (Moon). This earthly state of matter itself was the Chandrama, the Moon*." Shatpath Brahmana (6/1/2/4).

Notice that unlike the compact metered mantra poetry of the Vedas, the writing in the Brahmana commentary is in prose with a style wherein the main clause receives extra emphasis. The Brahmana writing presumably being the class-room notes for the disciples, they at times exhibit repetition of thought as well.

Rishi Maadyandin expresses the process in several steps for the creation of the Moon: the growth of the Sun, its interaction with *Dyu* (*Divam*[2]) the brilliant region surrounding the Sun and the formation of a three dimensional ovate of matter with terrestrial properties. It is emphasized in the last two sentences of the Brahmana statement that the *Chandrama* (Moon) is nothing else but the earthly state of matter that broke off from the Sun. The *powerful touch* is symbolic of the application of force to the ovate, to push it away from the Sun.

The beginning part of the above Brahmana statement, *to increase its (Sun's) population'* implies that the Sun already had its population in place before the Moon was created. The Vedas have made it abundantly clear that the Sun's population comprises the objects of the solar system, the planets. Therefore, in this Vedic scenario, another event of matter separation from the Sun took place well after the planets were formed. The Moon's creation here is the result of a *mithun*[3] between the Sun and its surrounding region, the *Divam* (*Dyu*). The literal meaning of the term *mithun*[3] is 'intercourse'. Implicit in the term *mithun*[3] is procreation. Instead of a common term such as 'interaction' being used for a physical process between non-living objects, the term *mithun*[3] was used appropriately because a new object, the Moon, was being born out of this interaction. This interaction could have been between the Sun and another planet or a massive comet passing by the Sun. This is not clear from the Brahmana statement. However, it is clear

that the Moon is the result of an interaction between the Sun and some extra-solar object. It was created near the Sun out of the matter that separated from the Sun.

The statement also narrates that the Moon was formed out of an ovate but not necessarily that the whole ovate was used up to create the Moon. We observe in nature that a real egg leads to an active entity and an inactive leftover shell. However, Rishi Maadyandin refers to one other event in the Shatpath Brahmana where the ovate broke into two pieces. So the Moon was created near the Sun and perhaps captured by the Earth later. Another of Rishi Maadyandin's statements is:

वृत्रो ह वाऽइदँ सर्वं वृत्वा शिश्ये ।
यदिदमन्तरेण द्यावापृथिवी स यदिदँ सर्वं वृत्वा शिश्ये तस्माद्वृत्रो नाम ।
(Shatpath Brahmana, 1/1/3/4)

**Transliteration**

"*Vritro ha va-a-idam sarvam Vritva shishye* ।
*Yadidmantaren dyaavaa-prithivi sa yadidam sarvam Vritva shishye tasmaadvritro naam* ।".

**Translation:**

*"The Vritra was immutably present covering the entire Earth. Lay immovable, covering whatever was between the Dyu (place of the Sun) and the Earth. This is why it is named as 'vritra'.* (Shatpath Brahmana, 1/1/3/4)

The sense of this statement is that the *Vritra* was static as in sleep, covering the Earth such that all objects between the Sun and the Earth were obscured by it. Rishi Maadyandin further emphasizes that because it was continuous, all around the Earth, it acquired its name in the Veda mantras as the *Vritra*. The next event in the early history of the Earth according to Rishi Maadyandin is that this immutable *Vritra* was broken into two as stated below -

इन्द्र: तं (वृत्रं) द्वेधा अन्वभिवत्तस्य सौम्यं न्यक्तमास तं चेन्द्रमसं चकार । (Shatpath Brahmana, 1/6/6/17 )

**Transliteration:**

"*Indrah tam (Vritram) dvedha anvabhivattasya saumyam* nyaktmaas tam chendramasam chakaar" ।.

**Translation:**

*"Indra (Sun) cut the Vritra (the ring of matter) into two parts and created the Moon from the portion that was calm and adorned."* (Shatpath Brahamana, 1/6/6/17)

This suggests that the matter of the *Vritra* (ring) was of two distinct categories; the '*calm and adorned'* part was used to create the Moon and the rest implicitly was "reactive and ugly". This may be crucial for an astronomer building a hypothesis based on these Vedic statements. In Shatpath there are several statements and in the RigVeda there are large numbers of mantras devoted to the subject of *Indra* (Sun) with reference to the *Vritra*, indicating that a considerable part of this shell of matter fell on the Earth. From the RigVeda *suktas* on *Indra*, let us take up the 32nd *sukta* of the first chapter and present a detailed translation of the 5th mantra,

अहन्वृत्रं[1] वृत्रतरं व्यंसमिन्द्रो[2] वज्रेण[3] महता वधेन ।
स्कन्धांसीव कुलिशेना विवृक्णाहिः शयते उपपृक् पृथिव्या[4] ॥ RigVeda (1/32/5)

**Transliteration and word meaning:**

अहन् (*ahan*) = slays, वृत्रं[1] (*vritram*) = ring (*of matter*), वृत्रतरं (*vritrataram*) = extremely dense, व्यंसम् (*vyansam*) = into scattered pieces, इन्द्रः[2] (*indrah*) = Indra the Sun, वज्रेण[3] (*vajren*) = weapon made of sharp rays, thunderbolt, महता (*mahata*) = the great, वधेन (*vadhen*) = as a result of destruction ।

स्कन्धांसीव (*skandhaamseev*) = like the schoulders, कुलिशेन (*kulishen*) = of excessive sharpness, sharpened, विवृक्णा (*vivriknaa*) = severed, अहिः (*ahih*) = snake-like, serpentine/ slithering motion, शयते (*shayate*) = sleeping, उपपृक् (*oop-prik*) = above, पृथिव्याः[4] (*prithivyah*) = of the Earth ॥

**Mantra Translation:**

"***Indra***[2] *the Sun, using the great weapon of* ***vajra***[3]*, excessively sharpened lightening thunderbolt, slayed the extremely dense* ***vritra***[1] *above the Earth*[4]*, severing it like separating the shoulders. The* ***vritra***[1] *scattered into pieces and lay on the Earth*[4] *in serpentine slithering motion."* RigVeda (1/32/5).

The crucial words are superscripted in the mantra. It becomes obvious from the mantra that it delineates an event in the early history of the Earth when the Earth was covered with an extremely thick ring of matter (*Vritra*). The theme of all 15 mantras in the 32nd *sukta* is the Sun with its heat-generated lightening discharges that cleared the ring of matter allowing the sunlight to reach the Earth. In the third mantra the *Vritra* is addressed as the 'first-cloud' of creation that the Sun broke. In the fourth mantra after the *Soorya* (Sun) eliminates the *Ahim* (anti-life *Vritra*) the sunrises began. The *Vritra* in the other mantras is addressed as *Indra-shatru* (enemy of the Sun) and the Indra is addressed as the *vajra-baahu* (one with the arms of lightening). The Shatpath Brahmana statements on the creation of the Moon cited above and in what follows have their basis in the RigVeda mantras. The Brahmana statement furnishes additional information for one to add to the Moon formation scenario. The following Shatpath statement mentions the effect on the Earth when the broken *Vritra* fell to the Earth surface.

"तमिन्द्रो जघान । स हत: पूति: सर्वत एवापोऽभिप्र सुस्राव सर्वत इव ह्ययँ समुद्रस्तस्मादु हैका आपो बीभत्साञ्चक्रिरे ता उपर्युपर्यतिपुप्रुविरेऽत..."

(Shatpath Brahmana, 1/1/3/5)

**Transliteration:**

*"Tamindro jaghaan. Sa hatah pootih sarvat evaapoabhipra susraav sarvat iva hyayam samudrastasmaadu haika aapo beebhatsaanchkrire taa uparyuparyati-pupruvireat…"*

**Translation:**

"*Indra destroyed that Vritra. The dead Vritra flowed towards the waters creating foul smell all around. The oceans*

*are all around already. It created instability in some waters, forcing them to flow up and up…"* (Shatpath Brahmana, 1/1/3/5).

The heavier part of the *Vritra* may have fallen on the Earth and the lighter part coagulated in time to form the Moon. There is a possibility that considerable heat was generated by this event heating the preexisting oceans and causing their waters to rise as stated in the Brahmana that the waters of the ocean flowed higher and higher. Because the oceans do not flow like the rivers do, the waters of the ocean flowing higher and higher could imply that the tremendous rise in the temperature created an expansion in the ocean waters, creating a back-flow of water into the rivers.

In the ancient Aryan tradition a celebration or a festival begins by invoking the *Agni-devata* (fire) which includes mantra recitation and burning medicinal herbs. The mantras generally are specific for the occasion. When the celebration relates to the *Indra-devata* the Sun, the Shatpath Brahmana (1/6/4/13) instructs the worshiper to observe the fast on the full-Moon day, carryout benevolent acts on that day and recite specific mantras and offer the recitation to the *Vritra*-destroyer *Indra*. The purpose of reciting the relevant mantras is to remind the worshiper and the others in attendance of the *Indra-Vritra* incident in the history of creation. The reminder of the science of creation through mantra recitation was deeply ingrained in the social fabric of the ancient Aryans. The relevant parts of Rishi Maadyandin's statements in his Shatpath Brahmana (1/6/4/13, 18) are:

"… यत्पौर्णमासम् अथ एष एव वृत्रो यच्चन्द्रमा…..।."

(Shatpath Brahmana, 1/6/4/13).

**Transliteration:** "*…yat paurnmaasam ath esh eva Vritro ya-Chandrama….*"

**Translation:**

"*…One that is seen at the end of the complete month, one that you see as the Chandrama (Moon), is the Vritra* (the ring

of matter that once was)….*One who understands this mystery is fully liberated*….” (Shatpath Brahmana, 1/6/4/13).

“तद्वा एष एवेन्द्र । य एष तपत्यथैष एव वृत्रो यच्चन्द्रमा: ।…”

(Shatpath Brahmana, 1/6/4/18).

**Transliteration:**

“*Tadva esh eva Indra । Ya esh tapatyathaish eva Vritro ya Chandrama…*”

**Translation:**

“*Now, the one that provides heat is Indra (Sun) and what Chandrama (Moon) is what was the Vritra before”*.

(Shatpath Brahmana, 1/6/4/18).

These two statements emphasize the distinction between the Sun and the Moon and end with the conclusion that the Moon is a product of a ring of matter that surrounded the Earth. In other mantras there is an indication of the process by which the *Vritra* was ultimately destroyed. In the Vedic process for the formation of the Moon the lightening is said to be the primary cause that cleared the dense matter that surrounded the Earth blocking the sunlight. These mysterious cosmological events need a separate study which is outside the scope of this book.

To conclude, the Moon is born out of Sun’s interaction with its surrounding brilliant region. The ovate shaped primordial blob of matter began orbiting around the Sun like a planet. While orbiting, probably in an elongated orbit, it entered in the gravitation field of the Earth and was captured by the Earth. Modern astronomy has theorized that if an astronomical object of the size of the Moon approaches the Earth within a critical limit of 2.9 Earth-radii (Roche-limit) it will disintegrate under its own tidal forces due to the Earth’s gravitation. The Moon may have been affected when it entered into the Earth’s area of influence. The consequence of this likely scenario is that a well-formed Moon revolving around the Sun like a new planet entered below the 2.9 Earth radii and burnt up partially with its material dispersing around the Earth. This is reflected in the Brahmana statement presented above – “*The Vritra was immutably present covering the entire Earth…*” (Shatpath Brahmana, 1/1/3/4).

It is also mentioned in other Brahmana statements and in the RigVeda mantra (1/32/5) presented above that the Sun and lightning bolt played a role to bring normalcy to the Earth. The Sun “…*slayed the extremely dense*

***vritra*** *above the Earth…"* and according to the Vedic statements the ring of *matter* broke into two parts, one fell and scattered on the entire Earth and the other accreted to form the Moon.

# Discussion on the Vedic Scenario for the Creation of the Moon

In the Vedic principle for the formation of the Moon, the matter forming the Moon is not part of the Earth and the indication is that the seas on the Earth were already present when the Moon was formed. Therefore, the Vedic principle for Moon formation is not concurrent with the (1) Fission Hypothesis and the (3) Co-formation Hypothesis listed above. The Vedic scenario has some factors common with the (2) The Capture Hypothesis and the (4) Giant-impact Hypothesis in that the mass of the Moon, though created near the Sun, was captured by the Earth and there was a milder encounter between the Earth and the Moon compared to the giant-impact proposed in the hypothesis (4) listed above.

The gravitational force between two planetary bodies creates tides in their masses; lunar-tide in the sea is an example. Depending on their masses if they approach within a critical distance of each other the tide can cause observable mechanical damage to their solid crusts generating tremendous heat. This critical distance is known as the Roche-limit. For the Moon with its present mass, to experience severe tidal effects in its crust owing to the massive gravitation of the Earth, the average terrestrial Roche-limit is about 2.9 Earth-radii (2.9x6371 km). The Moon presently is in its relatively stable orbit about 58.5 Earth-radii away. If the Moon were to enter within the distance of 2.9 Earth-radii (18,500 km) from the center of the Earth, the lunar surface will suffer mechanical damage. The Earth surface will also experience tides due to the Moon's gravity causing tremendous heat generation in the Earth's crust and therefore in the ocean water. This heat will dissipate into the Earth's atmosphere.

It seems that the originally formed Moon in the Vedic scenario was more massive than it is now, creating a Roche-limit bigger than 2.9 Earth-radii. After forming near the Sun and orbiting around it, the Moon could have entered the Earth's orbit and entered the Roche-limit of the Earth. The expected result could have been an explosion under Earth's tidal forces,

creating a thick ring of matter around the Earth called *Vritra* in the Vedas. The Moon's entry into the critical proximity of the Earth created heat in the Earth's crust, in the oceans and in its pre-existing atmosphere. The rise of the oceans is narrated in the Shatpath Brahmana reference (1/1/3/5).

The expected scenario is that the heat dissipation took place between the oceans and the atmosphere. It is also mentioned in the Vedic reference that the *Vritra* lost its heavier matter to the Earth and reconstituted the present Moon by accretion from the remaining "tranquil" part. The Moon that we have now is a reborn-Moon. Even if the Moon did not enter too far into the critical Roche-limit of that time but came close enough to the Earth, it would generate tremendous tides in the core of the Earth ensuing the melting of the Earth's crust and the evaporation of the oceans. Based on the detailed calculations of H. Z. Gerstenkorn (Astrophysics Journal, 36, 245, 1955) and the other scientists studying the capture theory have suggested that the Moon's approach would create - 'a heavy hot atmosphere over a darkened Earth'. This scenario is not too different from the scenario with the dark *Vritra* that is being discussed here, albeit based on the specific Vedic references. This author further surmises that the Pacific basin is not from where the Moon got scooped out, as in Fission Hypothesis, rather it a giant crater owing to the impact of the heavier part of the *Vritra* that fell on the Earth. The geologists with modern techniques should be able to prove or disprove this author's contention.

Although the Veda and the Brahmana clearly indicate the formation of the Moon out of the *Vritra*, it is possible that in this encounter there was considerable exchange of matter between the Earth and the Moon including oxygen and water from the Earth's atmosphere and the oceans respectively. In its second birth in the orbit around the Earth, the Moon may have emerged out of water clouds.

The first birth of the Moon was out of the *aapah* (hydrogen) of the Sun and the second birth could have been its emergence from the next stage of *aapah,* the water. The Moon therefore must have water of terrestrial origin still hidden under its surface, if it has not lost it in evaporation. Bhagvaddatta (p 266) stated a Taittireeya Samhita statement – चन्द्रमा वा अपाम् पुष्पम् (*chandrama va apaam pushpam*), meaning '*with certainty the Moon is the flower of aapah* (hydrogen or water)'. The Taittireeya Samhita statement has mysteriously related the Moon to water. The Taandya

Brahmana also states अपाम् पुष्पमसि *(apaam pushpamasi*) meaning, "*O Som you are the flower of aapah*"; the Som being Moon's synonym.

Of the five hypotheses mentioned above, the "The Capture Hypothesis" in modern astronomy and the "Vedic Creation of the Moon" discussed here in detail based on the Vedic Literature, have some common features which need further discussion. The Vedic references in particular reveal intriguing information about the lunar surface.

# Relationship between the Moon and the planet Mercury

Although these two objects of astronomy, the Moon and the Mercury, are far apart in space and completely different from each other, the references in ancient Vedic Literature tell us that there has been a close relationship between the two. One wonders why anyone on earth from the ancient times would have imagined any relationship between these two objects; one is close to the Earth displaying its surface features to the naked-eye and illuminates the nights while the other is far away, seen as a tiny dot near the Sun and not even seen often. The relationship between the Moon and Mercury has been mentioned variously in the ancient Vedic Literature. In fact the Vedic Literature states that the planet Mercury was created out of the Moon!

The Sanskrit name for the planet Mercury is Budha. Its other synonyms are: Shashij (born of Shashi the Moon), Chandraj (born of Chandra the Moon), Tvishi-putra (Tvishi's son, Tvishi means the Moon). Pundit Bhagvaddatta in the 13th chapter of his book 'Ved-Vidya Nidarshan' (publ. Itihaas Prakashan Mandal, 1959) written in Hindi, has given several references from the Puranas and the Vedic literary works related to this subject. The Brahmaand Purana (23/80) and the Vishnu Purana (2/12/16) address *Budha* as *Som-putra* meaning *Som*'s son. *Som* is a common name for the Moon. The *Budha*, the planet Mercury, is also referred to as the *Chandra-suta*, which means the son of the *Chandra* (Moon). A Brahmaand Purana reference states that: *"the scholarly know that the Budha was created out of the Moon"*. There is no confusion in the Vedic Literature on which of the two was created out of which. In the Vedic literature the planet Mercury was created out of the Moon and not the other way around. This is

quite similar to one of the modern hypotheses, not listed above, that proposes Mercury and Moon being created out of a single planet. The name given to that hypothetical planet is **Luna**.

It is nonetheless mind-boggling that the Vedic *rishis* should relate the apparently big-looking Moon so close to the Earth and the apparently small, rarely observed Mercury (Budha) so far away nearer to the Sun, in a way similar to a hypothesis proposed by modern astronomers. Therefore, there is a likelihood of the initial embryo-genesis of a dual planet near the Sun with an eccentric orbit, such that the higher metal content (70%) accumulated at the perihelion near the Sun formed the planet Mercury and the silicate-rich phase at the aphelion formed the Moon, to be captured later by the Earth. The nature of the orbital and the spin rotation in the Moon and Mercury are quite similar. During its orbital motion the Moon presents the same face towards the Earth. In the case of Mercury, its face towards the Sun changes very slowly. The polarization measurements of reflected light show similarity in the two surfaces. Compared to the other planets, both Mercury and the Moon, have low albedo (reflection of sunlight) in the visible spectrum.

When the orbital velocity of all planets is plotted against their orbit serial numbers, starting from Mercury as 1, the plot is a straight line, except that Mercury shows considerable departure. To account for this discrepancy J. Martyn Bailey published an interesting paper in Nature (223, 1969) which has a view similar to the Vedic view; of course with some differences. He showed from his orbital velocity calculations of planets that if the Moon was placed between Mercury and Venus the discrepancy about Mercury not fitting on the same orbital velocity curve as the rest of the planets, is accounted for. In doing so the planet Luna (Moon) would have an unstable eccentric orbit to enable its capture by the Earth, lending support to the capture hypothesis. If this is the situation the relationship between the Moon and its son Mercury starts to look possible where one could start with Mercury and the Moon having their beginning in the same mass of matter created near the Sun.

In conclusion, there are several original features related to the planet Budha that are recognized in the Vedic literature some of which coincide with the observations in present-day astronomy and the others are mysterious in nature, requiring further investigation.

The above discussion obviously presents a view different from the third hypothesis, (3) Co-formation Hypothesis, mentioned above. It is also different from the (4) Giant-impact Hypothesis, which is presently considered to be the most acceptable to explain the orbital momenta of the other planets. Also if a giant-impact was needed to create the Earth's satellite, the Moon, then a giant-impact was needed to create satellites of the other planets as well. For a Giant-impact Hypothesis to be valid, all planets of the solar system that have satellites needed a Mars-size or bigger body to have collided with them to form their satellites. This seems quite far-fetched. If one assumes that the total angular momentum of the early solar nebula was high enough to be distributed among all planets, perhaps one does not need an impacting body for each planet to create its satellites and the needed angular momenta.

# A mind-boggling Vedic deduction about the Lunar Surface

Under this sub-heading are presented some of the most mysterious ancient Vedic observations about the Moon that this author has attempted to relate to the recent observations and deductions by the modern astronomers, lunar physicists and chemists.

Figure 11.2 shows the synoptic pictures of the near-side (left) and the far-side (right) of the Moon. The near-side facing the Earth shows a clear contrast of the dark and the bright regions. The dark regions, about 31% of its near-side, are called mare planes that have less topographic features in them. They are clearly seen with the naked-eye from the Earth. They are filled mainly with powdery basalt (dark coloured sand of volcanic origin). The brighter part of the lunar-crust is covered with mountains. The brighter lunar region being higher than the dark mare is called the *highlands* or *terrae*. Not too long ago the astronomers struggled to explain the origin of the dark mare region of the Moon and several hypotheses were put forward. Veda and its subsequent literature, millennia before the modern astronomers, have also put forward their ideas about the black mare planes on the Moon. While astronomers had contradicting ideas, the different books of Vedic literature created in different epochs of the ancient times have all had one and the same hypothesis for the mare region. Before discussing the Vedic view on the origin of the black mare planes of the Moon, an overview of the modern astronomical deductions is furnished in what follows.

To explain the origin of the lunar mare considerable observational and speculative research was carried out by astronomers in the second-half of the twentieth century. Harold C. Urey (Physics and Astronomy of the Moon, Academic press, New York, 1962) suggested that the black mare region is the result of meteoritic impact and Zdenek Kopal (Nature 183,169,737, 1959) suggested cometary impact on the lunar surface. G. P. Kuiper (Journal of Geophysical Research, 64, 1713, 1959) on the other hand suggested that the dark mare were lunar volcanic lava flow. The following discussion based on the analysis of the lunar soil samples brought back by Appolo-11 will show that none of the three speculations is correct.

The processes of meteoritic impact, cometary impact and the lunar volcanic lava flow having no preference for a given surface area of the Moon should have created the mare all over the lunar surface. When the satellite photos of the far-side (back-side) of the Moon became available it was found that, with the exception of about a few dark regions totaling about 2% of the far-side of the Moon, the mare was present only on the near-side facing the Earth. This contrast in the two sides of the Moon is shown in the Figure 11.2. Finding no mare on the far-side of the Moon, the lunar astronomers went 'back to the drawing-board'. Old speculations were revisited and new all-inclusive explanations for the origin of the black substance on the surface of the Moon were put forward. One conclusion that they drew was that the Moon was extensively bombarded in its early history, surprisingly for a short period. But why would the bombardment be only on one side, from the side of the Earth? Why not from all sides of the Moon? Why such a sharp contrast between the lunar surface facing the Earth and the far-side of the Moon?

One interesting explanation had come from Zdenek Kopal (Nature, 210, 188, 1966). This is discussed in the following.

It was mentioned above that the Roche-limit for the Moon is about 2.9 Earth-radii at which point the Moon, owing to the tidal effect on its crust, would experience mechanical damage to its crust. Kopal took a number 2.8 Earth-radii for the Roche-limit and performed new calculations to determine the effect on the lunar-crust. He deducted that at some point in time, the near-side of the Moon grazed within 2.8 Earth-radii (17,839 km from the Earth centre) creating enough tidal effect in the lunar-crust to heat it up creating the mare region on the near-side. For the Roche-limit he probably took an average of an estimated possible range of Roche-limit

which is estimated to lie between 2.89 Earth-radii (18,412 km) and 2.72 Earth-radii (17,329 km). Kopal's idea could be paraphrased as:

'*Only the lunar hemisphere facing the Earth entered the terrestrial Roche-limit to suffer the mechanical damage by disruptive tides caused in the lunar crust by the Earth, causing mare on the near-side of the Moon.*'

At a first glance this looks quite convincing but not all pieces of the puzzle seem to fit. It is not conventional to be critical of a prominent scientist of high stature whose contribution to astronomy and astrophysics is immense; however, this author has some doubts on this scenario proposed by Kopal. Here is why.

The uncertainty between these two Roche-limits, 2.89 Earth radii and 2.72 Earth-radii is about 1,083 km in altitude. This is about 62% of the Moon's radius. This makes the Moon's grazing at Roche-limit an extremely critical phenomenon and therefore has a low probability. Moreover, this grazing has to be very brief so that only 31% of the near-side tarnished and not the entire front-side hemisphere of the Moon. Kopal's suggestion does not explain why only the front lunar hemisphere critically dipped into the Roche limit – not less not more? And why did the entire Moon not get attracted to the Earth and burn up in the process instead of quickly receding out of the Roche-limit and surviving? Nevertheless, even with all these limitations, the above statement is a scientific idea from a well-known astronomer and onetime co-editor of 'THE MOON', an International Journal of Lunar Studies. Interestingly we have a similar statement on the same subject from an ancient book, the Mantra Brahmana (1/5/13) which is the Brahmana commentary on the third Veda, the SaamVeda. It states:

यददश्चन्द्रम[1]सि कृष्णं[2] पृथिव्या[3] हृदयं[4] श्रितम्।

Brahmana, 1/5/13)

**Transliteration**:

"Y*adadash-chandram*[1]*-asi krishnam*[2] *Prithivya*[3] *hridayam*[4] *shritam*"

**Translation**:

'*That black*[2] *substance on the surface of the Moon*[1] *is there from the interior (heart*[4]*) of the Earth*[3]*'*. (Mantra Brahmana, 1/5/13)

This is a unique astronomical thought on the black mare regions of the Moon preserved in the ancient Vedic literature. The implication of this Vedic statement is that the black substance on the surface of the Moon is of terrestrial origin, reaching the front surface of the Moon. In statistical terminology this is more probable than meteoritic impact, cometary impact and the lunar volcanic lava flow only on the Earth-side of the Moon. The beauty of the Mantra Brahmana statement is that it does not say that the black substance in the mare region of the Moon is a mountain from the Earth or a piece detached from the Earth that left behind a dent on the surface of the Earth, that is now the Pacific Ocean; it clearly states that the origin of the black substance on the surface of the Moon is the heart of the Earth. From this, one can easily conclude that it is of terrestrial volcanic origin because all terrestrial lava is black and is from the interior of the Earth. For anything from the Earth to reach the lunar surface, even when the Moon is much closer to the Earth, the event has to be cataclysmic in nature. A massive volcanic eruption on Earth is such an event. Additionally, any cataclysmic explosion or volcanic eruption on the Earth reaching the Moon would deposit material on the front-side of the Moon, not requiring a satellite photo-proof showing its absence on the other side of the Moon. The Mantra Brahmana statement presents a unique science thought different from Kopal's and the thoughts of the other modern lunar astronomers.

At this juncture in the discussion this author would like to share with the reader an interesting experience that has relevance for scientists striving to seek the truth. This author had written a paper based on Vedic science thoughts on the Moon, which included several ancient science-related references and the references on the recent finds by the lunar scientists. It also included the Mantra Brahmana statement cited above that the source of black mare regions on the Moon is the Earth (Mantra Brahmana, 1/5/13). The author submitted the paper to the editor of the journal 'THE MOON'. The paper was not published in the journal; however, this author received a short comment from Kopal's co-editor of the journal, the well-known American astronomer Harold C. Urey, in a short letter dated January 16, 1973. Harold C. Urey wrote:

*"I find that the paper you wrote is amusing, but I do not regard it as scientifically significant. I suppose if enough people guess what the broad features of the moon were, someone, somewhere would propose ideas approximate to those found in science".*

It is difficult to grasp the logic in Urey's above statement. His co-editor, Kopal's statement on the Moon critically grazing at the Roche limit to singe only its near-side and then quickly retreating to its safe orbit is also a speculation. However, Kopal's speculation was acceptable and considered '*as scientifically significant*' but the statement of Mantra Brahmana to explain the same phenomenon caused amusement for Urey! This author finds the Brahmana statement to contain a unique thought, intriguing and plausible. The speculations put forward by some contemporary astronomers mentioned above are now abandoned.

To dismiss the statement of a Vedic *rishi* as guess-work from "*enough people"* is hasty, especially from scientists striving to seek the truth, no matter from which direction it blew in. Yes, "*enough people"*, the lunar astronomers included, certainly had different guesses on the origin of the black mare material on the lunar surface, but how many guessed that its origin was the Earth and more specifically the interior of the Earth? Perhaps none! For example, Kopal's first guess for the origin of the mare region was 'cometary impact'. This has no relation to his other guess in which the Moon dips down closer to the Earth, reaching a distance of about 17,839 km (Roche-limit of 2.8 Earth-radii) from the center of the Earth, is grazed critically for a short time at that particular distance, no more no less, gets singed and goes back to its present distance of 384,400 km from the Earth. Urey found these two guesses of Kopal as "*scientifically significant*" ideas but not Mantra Brahmana's idea which is unique. And the *rishi* of the Mantra Brahmana had not even seen the backside of the Moon that we know now has little mare region!

Any theory or a discovery, that turned out to be false and therefore unacceptable was a 'guess-work'. Another example of such a guess-work on the black mare regions of the Moon is about the lunar volcanic lava flow in the lunar planes. This was deemed '*scientifically significant*' till the other side of the Moon was photographed by the space-probes. The photographs of the other side of the Moon revealed that the far-side of the Moon hardly

had any black mare regions. It is expected that a truth searching scientist would consider an intriguing idea to be a possibility, not just '*amusing*'!

It is a basic canon that a unique idea could lead to a great discovery. The ideas presented in this book thus far, some more to come in this section and others to come in a forthcoming book, were all generated millennia ago in the independent minds of the Vedic *rishis*. When a Vedic *rishi* left behind a mantra with a science thought in it as in the book of Mantra Brahmana, regarding the morphology of the Moon or the other Vedic references on the formation of the Moon or a mantra stating that the Moon is illuminated by the solar rays, it is pure science having nothing to do with religion or philosophy. Terrestrial volcanic matter reaching the lunar surface tarnishing only its front side facing the Earth is a scientific thought of high level. Therefore, it deserves serious thought and study.

To see whether the Vedic references on the Moon can further the intellectual discussion, let us look at some data on the nature of the lunar samples brought back by the manned Apollo-11 flight (July 16, 1969) and see if the Vedic deduction had a possibility. The lunar samples showed that glasses in the lunar dust are shock-formed with impact origin. Urey and MacDonald (1971) said that some extensive melting due to 'other processes' took place causing the basaltic type of material generally found in the mare. The dust in mare planes may be partly due to ash-like flows from below the surface and partly due to **collision effects of high velocity objects**. In this all-inclusive-hypothesis suggested by Urey and MacDonald the understanding was that mare are vast solidified pools of ancient basaltic lava of lunar origin that erupted or flowed into depressions associated with impact basins that were formed by the impact of meteors and comets. The major exception is the Oceanus Procellarum where it does not correspond to a known impact basin.

Lunar Prospector gamma-ray spectrometer results revealed a higher concentration of heat-producing elements on the near-side of the lunar hemisphere. Also, several lunar provinces containing shield volcanoes and volcanic domes are found within the near side maria. This may also suggest the local lava hypotheses for the maria formation on the near-side of the Moon. However, it is still not clear why there was a discrepancy between the near-side and the far-side of the Moon with regard to the distribution of the heat-producing elements. Where did these heat-producing elements come from? The volcanic material from the Earth was certainly a

possibility. Let us look at the laboratory analysis of the lunar samples and learn what they tell us.

## Lunar Samples substantiate Vedic Deduction

Laboratory analysis of Appollo-11 lunar samples revealed (see E. Roedder and P. W. Weiblen, Science, 167, 641, 1970) that the igneous glasses in the lunar dust represent residual liquids produced at the end stages of crystallization and occur as interstitial material in rocks (found in the crevice of rocks) with textures similar to terrestrial volcanic vitrophyres or intersertal basalts. Most shock-formed glasses in these lunar samples show one or more of the distinctive features that prove that their origin is by impact rather than of lunar volcanic origin (see E. C. T. Chao et al., Journal of Geophysical Research, 75, 7445, 1970 and also the other references given in that paper). In one analysis, as these authors stated, the texture of the lunar samples is similar to **terrestrial volcanic vitrophyres or intersertal basalts** and in another analysis they are of **impact origin and not of lunar volcanic origin**. Therefore, it is plausible that a forceful giant volcanic eruption on Earth, reaching the Moon, caused the black mare regions on the front-side of the Moon creating volcanic vitriphyres and besalts similar to those in terrestrial volcanos. These authors concluded that the lunar samples are of impact origin and are not of lunar volcanic origin.

In our lifetime, one of the two biggest volcanic eruptions in the twentieth century was the Pinatubo volcanic eruption on June 15, 1991 in the Philippines that sent gases and aerosol dust into the stratosphere covering the entire globe. It ejected more than 10 billion tonnes of magma and 20 million tons of sulpher-dioxide gas. Large amounts of aerosol and gases were ejected right into the stratosphere (10-50 km altitude) where the ozone layer is at 20-30 km altitude. It formed a global layer of sulfuric-acid haze bringing the global temperature down by 0.5°C. This author being an atmospheric physicist studying the ozone and aerosol with powerful laser beams found substantial depletion of ozone in the ozone layer.

For terrestrial lava to escape the Earth to reach the Moon, it has to be thrown up with tremendous force that generates at least about 11 km per second velocity in it, called the escape-velocity. It has been recorded that the rare super-volcanoes of "Ultra Plinian" category have injected magma material in the atmosphere up to an altitude of about 50 km with supersonic speeds over 350 meters per second with maximum speeds as high as 600

meters per second. Although the observed maximum speed in the volcanic eruptions is only 20th of the needed speed, an extra-ordinary volcanic eruption coinciding with the Moon's reachable position in its orbit cannot be ruled out.

The rough estimate suggests that if one took all of the 10 billion tons of magma that Pinatubo volcano injected in the Earth's atmosphere and put it on the near-side of the lunar surface, one could form the dark regions on the surface of the Moon as big as the lunar maria with uniform thickness measuring about one foot. If such a powerful volcano erupted on the Earth it could exclusively dump lava on the front side of the Moon and not on the far side. Therefore, the most likely scenario to explain the "black on the Moon" is the one from the Vedic science.

The recent history of speculative lunar research, before the most recent technological developments and the Appolo-11 flight, has been quite interesting. Gilbert (1893) in the late 19th century and Urey (1951) and Hartman (1966) since the mid-twentieth century attempted to explain the macroscopic features of the Moon. They suggested that the macroscopic features of the Moon were formed out of moderate impact of the satellites of the Earth. It may be possible that the satellites of the Earth did impact on the Moon and it may be that big size meteorites fell on it. Nevertheless the absence of large craters in the mare is remarkable. The Vedic view implies that most of the craters on the Moon were formed before the Vedic-suggested terrestrial volcano dumped the lava on the lunar surface. If there are big craters there, they would be hidden under the terrestrial lava on the near-side of the Moon.

There is an opportunity presented by these Vedic science ideas for lunar physicists to estimate the amount of terrestrial matter on the Moon and to perform calculations to determine the effect that this mass-transfer could have had on the position, angular and orbital momentum of the Earth-Moon system and from where on the Earth the material escaped to land on the Moon.

If the origin of the black powdery sand of the Moon is what the Vedas said it was, the early Apollo flights to the Moon may not have brought back true lunar samples; they may have returned with the terrestrial volcanic material! Since receiving these lunar souvenirs, geophysicists have analyzed their chemistry and determined the age of their formation. Let us investigate this a bit further.

# Lunar Age

The studies of the lunar samples collected by Apollo missions have yielded differing ages of the Moon. The lunar rocks show a different age than the lunar soil. Based on their analysis Cliff et al. (Journal of Geophysical Research, 77, 2007, 1972) pointed out that the whole rocks are much older than the soil and that the Apollo 12 and 14 samples show chiefly two discrete major differentiation episodes. One episode evidently occurred 4.6 BY ago and the other at the time of the mare-filling between 3 and 4 BY ago. O'nion and Pankhursts (1972) on the other hand suggest that the two major crystallization events took place, one at 4.31± 0.04 BY ago and the other at approximately 3.9 BY ago. According to Papannastassiou and Wasserburg (1971a, b) and Cliff et al. (1972) the isochron for most soil samples gives a value of 4.6 BY. Therefore it seems there are three groups of lunar ages 4.6, 4.31 and 3.9 BY. If the measurements of O'nion and Pankhursts are accepted, the original lunar rocks were formed 4.31 BY ago and a major episode took place at 3.9 BY ago creating secondary crystallization material.

From the Vedic perspective all three numbers are possible for the geological age of the lunar samples. The 3.9 BY would correspond to the time when mare material from the terrestrial volcanic eruption of cataclysmic proportions reached the Moon. This would be of cataclysmic proportions because the escape of terrestrial lava and crust from the Earth's gravity required a tremendous force. If however the Moon was orbiting closer to the Earth 3.9 BY ago, depending on its distance, not so massive an eruption was needed to dump terrestrial volcanic material on the Moon. After all the laser measurements of the lunar distance from the Earth have shown that the Moon is receding from the Earth at a rate of 3.8 cm per year. If one assumed that this lunar recession is linear with time the Moon 3.9 BY ago was 150,000 km closer to the Earth. In terms of gravitational attraction between the Moon and the Earth this amounts to about three times more force from the Moon to attract terrestrial volcanic eruption.

The lunar rocks showing 4.31 BY could be the age of the Moon itself and the largest number of the three, 4.6 BY, showing the age of the terrestrial material could be exhibiting the age of the Earth. According to this interpretation there is a time lapse of about 280 MY between the

formation of the Earth 4.6 BY ago and the formation of the Moon 4.32 BY ago. As discussed above, the Moon in the Vedic scenario was created well after the Earth when the Earth already had oceans all around. It was also mentioned earlier, based on the modern research that the most accepted age of the Moon is 4.527 ± 0.010 BY, which is after about 30 to 50 million years of the formation of the solar system. This takes us closer to the number 4.6 BY which is accepted as the age of the Earth.

Whatever value one may wish to place on the Vedic principle of the Moon formation, or on the Vedic explanation of the black mare region on the Moon and on the other intriguing Vedic deductions on the Moon, one thing is mind-boggling - why the Vedic principle millennia ago would suggest that the Moon was created after the Earth; something exactly similar to what is accepted today in modern astronomy!

Let us take up a few more examples related to the same topic from other Vedic books. In Taittireeya Samhita (5/2/3) there is a narration that relates to the exchange of *ush* matter between the *dyu* (brilliant space around the Sun) and the Earth and between the Earth and the Moon in the early history of the Earth. This statement translates into:

> "*For starting the fire for the yagjya* (fire invocation) o*ne should collect the sand first. One should be reminded that earlier* (in the history of the solar system)*, the Dyu* (Sun and its surrounding brilliant region) *and the Earth were closer together. Separating from each other they said – let our yagjyiya-part* (hot burning matter) *be shared. The yagjyiya-part of the Dyu was placed in the Earth which resulted into ush (oosh). The Earth's yagjyiya-part* (hot burning matter) *was placed in space which is the black substance on the Moon. When one collects sand* (for the *yagjya*, the fire invocation) *one should think of this exchange* (between Dyu - Earth and Earth - Moon)". (Taittireeya Samhita, 5/2/3).

The *yaugik* root meaning of the term *yagjya* stands for a selfless act for the benefit of all. However, the *rudhi* ordinary/common meaning applies to a physical process, the outcome of which is beneficial to all. Most specifically it applies to the process when fire is lit with specific mantra recitation and herbal ingredients burnt for the purification of the environment. There are two basic parts of a *yagjya*, (a) the intellectual part with mantra recitation and observance of discipline and (b) the physical part

is the creation of the *yagjyiya*-fire itself. In the theistic perspective of the Vedas the creation of the universe itself being a selfless act by the Creator, for the benefit of the others (living beings), is said to be a *yagjya* of the Creator. Thus, the *yagjyiya*-part in the above statement is the material part of the *yagjya*; the hot matter early in the creation.

Since the statement is a narration that expresses a connection between the Dyu and the Earth and the Earth and the Moon, the context requires that the subject matter be treated in a cosmological frame of reference. The timeline in this frame obviously places the process after the creation of the Sun, the main resident of the Dyu-region of *Antariksh* (Space) as well as when the Earth and the Moon were already created. The same context also requires that the *yagjyiya*-part of *Dyu*, which the Earth receives from the *Dyu* and the Moon receives from the Earth, is hot and burning matter. The important distinction that Taittireeya Samhita makes between the matter-exchange in the two separate processes and in the two regions of the space is that the one received by the Earth is *ush* and the one on the surface of the Moon is said to be just the 'black' substance.

It is fascinating to note from the Vedic Literature that two different books, the Mantra Brahmana and the Taittireeya Samhita, with commentary and deductions from two different Vedas, written by two different authors in the far antiquity of the Vedic civilization, have a common astronomical/geophysics subject – *the black substance on the surface of the Moon*. The Taittireeya Samhita (5/2/3) statement cited above and the Mantra Brahmana (1/5/13) statement cited under the sub-heading "Lunar Surface", when taken together, state two aspects of the same subject respectively, one referring to the process and the other referring to the source of the black substance. In the Taittireeya Samhita (5/2/3) "…*The Earth's yagjyiya-part* (hot substance) *was placed in space which is the black substance on the Moon…"* and in the Mantra Brahmana (1/5/13) "*That black*[2] *substance on the surface of the Moon is there from the interior (heart) of the Earth'*. In both Vedic deductions the mare region on the lunar surface is of terrestrial origin. As suggested earlier, there is a high likelihood that it is the volcanic lava from the interior of the Earth which is always hot and burning. This is why the '*heart of the Earth*' is the adjective used for the dark matter on the lunar surface. Additionally, Mantra Brahmana's adjective '*heart of the Earth*' for the black substance of the Moon, leaves no room for ambiguity.

The term *ush,* the substance received by the Earth from the Dyu (the solar region of space), stands for a substance that would burn other things in its surroundings. The same word leads to a common word that the farmers use for a specific category of land. The word is "*usher-land* or *ooshar-land*". It is the land that is unfavourable to the growth of vegetation. The *ush* generally refers to calcine sandy soil. The implication in the last words of the Taittireeya Samhita (5/2/3), is that "*When one collects sand* (for a fire oblation) *one should think of this exchange* (between the Dyu, the Earth and the Moon)". The *rishi*'s instruction to performing *yagjya* is to follow the ritual part of the ceremony and the mantra recitation and pondering over the mantras is the intellectual part of the ceremoney.

The observation that the black substance on the surface of the Moon is of terrestrial volcanic origin is supported by another Brahmana book, the Shatpath Brahmana (1/3/3/18-19) where the adjective for the black substance is '*anaamrit*' meaning '*life destroying substance'*. The term *anaamrit* represents a substance that is opposite of a nectar. This is in the typical Shatpath Brahmana's narrative style where inert *devas* are presented as the actors in the early phase of the creation drama! The translation of the Shatpath Brahmana reads:

*All devas* (inert forces of Nature) *certainly were in a struggle. They said. This is anaamrit* (life destroying substance) *to the Earth, so let us put it on the Moon. This is what that black substance on the Moon is*". (Shatpath Brahmana, 1/3/3/18-19).

In the above statement the dialogue between the inert *devas* and their struggle to bring order in the creation is indicative of the violent situation in the early history of the solar system. Since the Earth was to be a place for living-beings the black substance of these references would have made life impossible on Earth. This was also the theme of the *Vritra-Indra* struggle when finally *Indra* (Sun) came out victorious to enable life on Earth.

The amenable conclusion that could be drawn from these Vedic references is that the apparent black substance on the surface of the Moon is extra-lunar and is of terrestrial origin. Intriguing enough, the above mentioned three independent literary works in the Brahmana books on SaamVeda and YajurVeda provide the same explanation for the dark mare regions of the Moon. It is of further interest that Mantra Brahmana (1/5/13)

indicates the specific locale for its origin; that it originated in the interior of the Earth. The Taittireeya Samhita (5/2/3) indicates that it is something that once was with the Earth and the Shatpath Brahmana (1/3/3/18-19) emphasizes its chemical properties that it was deadly for life on Earth. Collectively all these references create a vivid picture of the process in which there was a transfer of matter from the Earth to the Moon and that at the time of this transfer the Moon existed separately and presumably closer to the Earth.

A bonus point from the Taittireeya Samhita, (5/2/3) statement cited above – "….*One should be reminded that earlier* (in the history of the solar system), *the Dyu* (Sun and its surrounding brilliant region) *and the Earth were closer together…..*" is that the solar system has expanded from what it was when created. The solar system has expanded because, as discussed in detail in Chapters 7 through 9, the Vedic universe has expanded and continues to expand.

# Mars: the planet *Mangal*

The most common Vedic name of the planet Mars is *Mangal*. Tuesday is named after *Mangal* as *Mangal-vaar*.

Mars' orbit around the Sun is next to the Earth's and it is outside the orbit of the Earth. Mars completes its revolution around the Sun in 687 Earth-days and spins around its axis once in 1.026 Earth-days. Fly-by probes have extensively photographed Mars, revealing its landscape and topographic features. Other probes have landed on Mars to study its environment and to detect water and the possibility of life forms. Possibilities of sending manned flights to Mars, as done for the Moon, are also being conceived. Details of new developments related to Mars exploration can be found in open literature. Its ancient astronomical connection to Vedic culture is based on the observations made on *Mangal* (Mars) by the ancient *rishis*. In the Vedic astronomy it is distinctly recognized as a planet. The synonyms for Mars reflect its observed features.

The Vedic *rishis*/astronomers have also observered the planet Mars orbiting through the constellations. Its synonyms include: *Bhaum* - for it has solid terrestrial surface like *Bhoomi* (Earth); *Lohitaang* – for its red colour; *Tambraang* – for its colour resembling that of copper metal; *Angarak* – for it is like red-hot burning coal. There are several other not so common

names of the planet *Mangal* that appear in Vedic Literature. They are: *Soor-senapati*, *Mahisut*, *Kuj*, *Skand* and *Kumaar*. Further research in the Vedas and the Vedic literature is needed to glean more information about the planet *Mangal*.

# Jupiter: the planet *Brihaspati*

The planet Jupiter in Vedic astronomy is addressed with two popular names, *Brihaspati* and *Guru*. Its orbit around the Sun is after that of Mars. It takes 11.859 Earth-years to complete one orbit around the Sun and completes one spin on its axis in 9.925 hours. It is the biggest planet of the solar system with its mass being 317.8 Earth-masses and its radius is 11.209 Earth-radii. Several NASA probes have explored this planet. It is mainly made up of gases. The week-day assigned to planet Jupiter in the Vedic calendar is *Guru-vaar* or *Brihaspati-vaar*, which is Thursday.

It is most intriguing that the Vedic name for the planet Jupiter is "*brihaspati"*. The Vedic terms are based on the property of the object being named. The word *brihaspati* is formed by conjoining two words *brihata* (vast) and *pati* (possessor or master) which lead to - '*the possessor of the vast*'. This implies that Jupiter is magnificent and enormous among all planets. The important point to note here is that the Veda in the distant past named Jupiter *Brihaspati*, the biggest planet, which is concomitant with modern astronomy. It is truly amazing that the ancient *rishis* determined which planet was the biggest.

The other synonym, *Guru*, for Jupiter conveys the meaning that it is the '*bigger among all others*'. Being a big planet, it has high *guru-tva,* the gravitational-attraction. The fact is that just the observation of a planet from the Earth would not tell its size and mass. One requires physics knowledge of the solar system and physics background to do necessary calculations with the period of revolution etc to determine which planet is bigger than which. If one assumes that a Vedic *rishi* did not have telescopes or physics background and that the only tools in his possession were his eyes, one cannot explain why and how the *rishi* reached the conclusion that *Brihaspati* was bigger (Guru) than all planets.

One envisages that in the distant Vedic period the best a rishi could have done is to measure the apparent disc of a planet as seen from the Earth. He would find the apparent diameters of the planets as in the Table

11.2 that were compiled by this author from modern astronomy text books. Based on the apparent disc sizes alone a *rishi* would conclude that the Moon was the biggest object in the sky with a maximum apparent diameter of 34.1 minutes of an arc (about half a degree); the next would be the Sun with its apparent diameter of 32.7 minutes of an arc. Then he would place Venus at the third place with an apparent diameter of 1.1 minutes of an arc. Jupiter with its apparent diameter being 0.82 minutes of an arc would be placed fourth. Thus the apparent size of the illuminated disc of Jupiter is not the largest. Our present knowledge about the planets yields that the Moon is the smallest of all and the Jupiter is the largest. Seeing the planet Venus as the brightest among all planets the *rishi*s did not say that it was also the biggest. It is therefore mind-boggling that the Vedic *rishis* would name Jupiter as *Brihaspati* or Guru, '*bigger among all others*, an accepted astronomical fact of today. This does not happen without the real astronomical knowledge of the solar system, of individual planets and the knowledge of the planetary physics. The Vedic *rishis* must have had that.

## How was Jupiter named Brihaspati (biggest in planets)?

The question is - how did the *rishis* determine that the planet Jupiter was the biggest of all the planets? There may be other explanations for this fact but the one that stands out is indicated in *shlokas* 1 to 11 in the 2nd chapter of "Soorya Siddhant" (Sun Principle), the ancient treatise on Vedic astronomy that was referred to several times in this book. It should however be made clear that "Soorya Siddhant" is not the first book that named Jupiter as Brihaspati or the Guru. The oldest book of the Vedic Literature, the RigVeda, already had named it as such. However, the book of "Soorya Siddhant" reveals what was already known to the *rishis* well before the ancient book of "Soorya Siddhant". To understand this mystery we have to define several Vedic astronomy terms.

The "Soorya Siddhant" states - '*the invisible ropes* (lines of force) *of pravah vaayu is the cause for the phenomena of sheeghr-uchch (increase in motion), mand-uchch (decrease in motion) and paat* (fall from a level) *in all planets and the pravah vaayu relates to their time periods and their orbits'*.

The term *pravaah vaayu* in "Soorya Siddhant" is the force of attraction that creates motion. The term *vaah* forms several commonly used related terms such as *vaahan* (a vehicle), *vahak* (driver of vehicle), *pravaah* of river (forceful flow of water in the river) and so on. In modern physics terminology the *pravah vaayu* is Sun's force of gravity that creates acceleration from one point on the orbit and desceleration from another which respectively are the phenomena of *sheeghr-uchch* and *mand-uchch*.

When the planet on its orbit comes closer to the Sun at one pont the *sheeghr-uchch* begins and the motion of the planet is highly accelerated and as the planet goes around the Sun the *mand-uchch begins*. The "Soorya Siddhant" in the *shlokas* 9 to 11 of chapter 2 also states that:

> *"The Sun's globe being great, it does not show* ***uchch*** (change in motion), *while the Moon having a smaller globe shows greater attraction. The Bhaum* (planet Mars) *and other planets with their globes being small, their* ***sheeghr-uchch*** *and* ***mand-uchch*** *devatas* (forces) *pull them to large distances. This is why one has to apply greater positive and negative corrections in their motions. This is how the planets exhibit their* ***sheeghr-uchch*** *and* ***mand-uchch*** *devatas of aakarshan* (force of attraction) *and move in space a-ahata* (undeviated, unhurt) *by the pravaah-vaayu* (driven by the force of attraction that creates motion". "Soorya Siddhant" (2/9, 10, 11).

The two motions, ***sheeghr-uchch*** and ***mand-uchch*** in all planets near the Sun, are facts of astronomy today which were not understood in the Western astronomy until 1530 CE when Nicolas Copernicus realized that the differing motions of planets could be explained if it was considered that all planets were orbiting around the Sun.

Now coming back to why Jupiter was named *Brihaspati* in the Vedas one has to look at the definitions of *sheeghr-uchch* and *mand-uchch* motions on the planetary orbits. It is stated in "Soorya Siddhant" that *sheeghr-uchch* and *mand-uchch* are larger for smaller planets and vice-versa. The Vedic *rishis* must have observed the planetary motions along their orbits particularly near the Sun where *sheeghr-uchch* and *mand-uchch* occur in the otherwise steady motion of the planets. The *rishis* must have determined the *sheeghr-uchch* and *mand-uchch* of all planets and found that Jupiter exhibited the smallest *sheeghr-uchch* and *mand-uchch* and therefore

it was the biggest of all planets. The clarity of thought in the ancient astronomy book of "Soorya Siddhant", pertaining to the planetary motions near the Sun, is remarkable. That the Sun acts as the stable focus for the orbits of all planets is expressed in another *shloka* of "Soorya Siddhant" (2/9), "*…the Sun's globe is the greatest not showing any sheeghr-uchch and mand-uchch…*" This we now know is an astronomical fact.

It is important to mention here that Sanskrit words being property-based the word *brihaspati* is applicable to other entities in other contexts. In a social context, among kings and rulers, the word *brihaspati* applies to an emperor for possessing the power to rule a vast kingdom. In a scholastic context it is an adjective and a title given to a brilliant person among the scholarly, for possessing great knowledge. In the spiritual context the word is used for the Creator, because He is considered to be the Omnipotent master of the vast universe and the all-knowing Omniscient. The context and specific properties of the subject would determine whether the mantra is referring to the inert planet or to a conscious being emperor or to a brilliant scholar.

RigVeda in chapter 4, *sukta* 50 has devoted 11 mantras to the subject of '*Brihaspati*', the planet Jupiter. Mantras 1 to 9 are on Jupiter and 10 and 11 are on '*Indra-Brihaspati*'- the Sun-Jupiter. The first five mantras deal with the physical aspect of the creation with reference to *Brihaspati* and the rest are in the realm of spirituality. Keeping the physical perspective of this *sukta* in mind a complete translation of the 4th mantra is taken up and for brevity a summary of the remaining four mantras is included. In the sequence of the creation of the planets, the Veda mantra states that the Brihaspati was created first. The initial moments of its creation are described in the 4th mantra of this *sukta* presented below.

बृहस्पतिः प्रथमं जायमानो महो ज्योतिषः परमे व्योमन् ।
सप्तास्यस्तुविजातो रवेण वि सप्तरश्मिरधमत्तमांसि ॥ (RigVeda, 4/50/4)

**Transliteration:**

"*Brihaspatih prathmam jaayamaano maho jyotishah parme vyoman /*

*Saptaasyastuvijaato ravena vi saptrashmirdhamattmaansi* ॥"

**Word Transliteration and Translation**:

बृहस्पति: (*brihaspatih*) = Jupiter, प्रथमं (*prathamam*)= first, जायमान: (*jaayamaanah*) = was born, was created, मह: (*maha*) = great, big, ज्योतिष: (*jyotishah*) = from illumination or from the brilliant Sun, परमे (*parame*) = very high, distant, व्योमन् (*vyoman*) = sky, space ।
सप्तास्य: (*saptaasyah*) = of the seven recognized, तुविजात: (*tuvijaatah)*= well-known among many, रवेण (*ravena*) = accompanied with loud sound produced by motion, वि अधमत् (*vi adhmat*) = removed , सप्तरश्मि (*sapta-rashmih*) = seven rays of spectrum, तमांसि (*tamaansi*) = of spread out darkness ॥

**Mantra Translation:**

> "*Out of the brilliant illumination of the Sun was first created the great Brihaspati in the distant space. Well-known among all the well-recognized seven, it came into existence with tremendous motion accompanied with loud sound, banishing the darkness of space with its brilliance in seven-colours.*" (RigVeda, 4/50/4).

The most important astronomical deduction from the mantra is that the planet *Brihaspati* was the प्रथमं जायमान: (*prathamam jaayamaanah*) among the other well-recognized seven planets. There is no other meaning of *prathamam jaayamaanah* than '*it was first created*'. It is nothing short of remarkable that the modern astronomy should say the same about the planet *Jupiter*, that it was the first created object out of a tremendous explosion on the Sun. The phrase - *banishing the darkness of space with its brilliance in seven-colours* is impressive because it is indicative of the fact that the primordial *Brihaspati* that detached from the Sun must have been a brilliant ball of fire exhibiting the spectrum of light with all seven colours as in the sunlight.

The additional feature regarding the birth of Jupiter (*Brihaspati*) in the Vedic astronomy is *Brihaspati*'s रवेण (*ravena*) birth. The term *ravena* means accompanied with loud sound, the sound that is produced by a fast moving object. The huge explosion in the Sun is accompanied by tremendous

motion and incredibly loud sound during the ejection of the material. However, these features related to the birth of the planet Jupiter have little emphasis in the modern planetary hypotheses. Anything at high speed has the accompanying loud noise whether the medium for sound-travel existed or not or a listener existed or not. This is like a secondary Big Bang limited to the solar system creating Jupiter and the planets; the first Big Bang being the creation of the universe itself when neither a medium was present to convey the noisy roar, nor was there a listener to hear it.

The word 'seven' has occurred in the mantra twice, once in "…*well-recognized seven*…" for the seven planets and the next in "…*its brilliance in seven-colours*…" for the spectrum of light. Since the *Brihaspati* is an astronomical object, its comparison with the other seven is with other astronomical objects. The mantra is not specific about what these seven other astronomical objects are. The context must dictate that these seven are the remaining planets. Its association with the brilliant spectrum of light is indicative of a hot molten mass ejected out of the Sun, lighting up the space.

Natural questions on this mantra are: Why did a Vedic *rishi* choose a faraway object like Jupiter and label it as the first one to be created among all the planets? Why is Jupiter's advent accompanied with रवेण (*ravena*) which is specific to '*loud noise produced by a body in tremendous motion*'? As mentioned earlier the planet Mercury (*Budha*) also created noise resembling the noise from the thunder in clouds which by definition is different from the Jupiter's noise (रवेण = *ravena*). Those are the mysteries in the mantras on Jupiter, however, what is not mysterious any more is the most accepted modern hypothesis regarding the formation of planets, in that an explosion at the solar nebula hurled a chunk (or chunks) of matter into space to cool and accrete into planets.

It is difficult to decipher the mystery of the mantra as to what these well-recognized seven astronomy objects in the mantra are. It could even be, as mentioned above, the simultaneous creation of seven planets in one and the same explosion. It is also possible that the mantra is referring to the multiple satellites (moons) of Jupiter. The strong *ravena* is not a fleeting adjective for Jupiter; it appears in the first as well as in the fifth mantra on Jupiter in the same *sukta*.

In its story-telling style there is an interesting narration in Shatpath Brahmana (5/2/1/18):

"*… when Brihaspati (Jupiter) was installed in space, the Earth feared and said - 'now that it is consecrated and is big, could it tear me up?'* and *Brihaspati* also feared and said - '*would the Earth hurl me away*?' but *both established friendship….*"

This in equivalent physics terminology would state that when Jupiter was created and installed in its orbit its enormous gravitation could pull the Earth into its own orbit. If it did, the tidal force of Jupiter could tear the Earth apart and vice-versa. But both could coexist in their own well-established orbits.

Several interesting points from the other mantras of the *Brihaspati-sukta* are summarized below:

(1) *"Staying in three places with ravena* (noise from motion) *the Brihaspati with its strength established the physical limits of the Earth"* (RigVeda, 4/50/1).

(2) *"Happiness imparting O Brihaspati with beautiful recognizing symbols, you protected us with your vrishantam, the great attraction, from those that cause trembling and instability bringing destruction from all directions. Thus you protect the yonim, the place for the growth of life* (the Earth)*."* (RigVeda, 4/50/2).

As we understand it now, Jupiter's *great attraction* (gravitation) helps to attract meteors and other destructive objects which otherwise would hit the Earth from *all directions* causing *trembling and instability*. The mantra points out the severity of these dangers which would wipe out life on the Earth – the disappearance of dinosaurs is attributed to a giant meteorite impact on the Earth. It is mind-boggling that the *rishis* of the ancient times expressed thoughts that are quite similar to the astronomical deductions of today.

(3) *"O Brihaspati, covered with अद्रिदुग्धा* (*adri-dugdha* = clouds) *and deep wells, we invoke you in our thoughts, that ritam the 'unchanging rule of creation', had touched you…."* (RigVeda, 4/50/3).

(4) "*Let कनिक्रदत् (kanikradat) Brihaspati - the extremely clamorous Jupiter, with its ravena (noise) be benevolent to the Earth which is desirous of creating the living beings…*" (RigVeda, 4/50/5).

There are several features of Jupiter that have been mentioned above, some well-known now and others are mysterious. The *rishi* of the mantra, RigVeda (4/50/3) states that Jupiter is covered with *अद्रिदुग्धा* (*adri-dugdha*). The composite term *adridugdha* represents '*thick and saturated clouds*' which is an accepted fact of today. The same mantra also states that Jupiter has *deep-wells*. Jupiter's red spot is observed presently which looks like a deep-well and the Vedic *rishis* of yester years observed the features of '*saturated clouds'* and '*deep-wells'* on Jupiter's surface. This again is not an ordinary observation of the planet Jupiter. One is impelled to wonders as to what led the Vedic *rishi* to conclude this, because, without a powerful telescope one cannot discern clouds on a planet. At the same time this magnificent *Brihaspati* with clouds, its deep wells, great motion with clamor cannot be an emperor, a scholarly person or the Creator but can only be the planet Jupiter.

## Jupiter the *Dyu-pitar* of Vedic Literature

With what has been revealed from the mantras on planet Jupiter it is natural to see some correlation between the astronomical Sanskrit words that appear in the Vedas and those found in other languages and cultures, albeit generally with some variation. Let us look at the word Jupiter itself. Jupiter in the mantras of *Indra-Brihaspati* (Sun-Jupiter) hymn is addressed with a large number of adjectival term; a few will be mentioned here. *Brihaspati* (Jupiter) is:

- *the resident of the upper Vyom - the high-Space* (RigVeda, 4/50/4);

- *the kanikrad – the extreme noise creator* (RigVeda, 4/50/5);
- *the raja, the king among the planets* (RigVeda, 4/50/7);
- *the पितरो द्याम् (pitaro-dyaam) which means the Father of the Dyu.*

The upper *vyom* (higher Space) in the Vedas is also addressed as the Dyu that has been mentioned a number of times in this book. RigVeda chapter 10, *sukta* 68 is also devoted to *Brihaspati*. The RigVeda mantra (10/68/11) addresses the Jupiter as the पितरो द्याम् (*pitaro-dyaam*) which means the *Father of the Dyu*. This can concisely be expressed as *Dyu-pitar* (*Dyu*'s father). In fact the term *pitro* or *pitar* in Sanskrit is quite close in sound and meaning to the word 'peter' for 'father' in English (paternal comes from pater). It is likely that the word Jupiter is a metamorphosis of *Dyupitar*.

Therefore *Brihaspati* is not only called the *Guru*, meaning bigger than the others, it is also called *Dyupitar*. This is also mentioned by Pundit Udaya Veer Shastri in his interpretive commentary on Saankhya Darshan. It is remarkable to note that the two words in two different languages, Dyupitar and Jupiter, should sound so similar.

## Saturn: the planet *Shanaishchara* (slow-moving)

*Shanaishchara* is the Vedic name for the planet Saturn. Saturn is the next gas-giant after Jupiter. Jupiter completes its orbit around the Sun in about 12 years whereas the Saturn completes its orbit in about 29.457 years. *Shani-vaar* is the day of the week assigned to the planet *Shanaishchara*, which is the same as Saturday.

The term *shanaishchara* is a conjunction of two words that tell us what makes Shanaishchara different from the rest of the planets. The two words are *shanai* and *chara*, respectively for 'slow' and 'moving', leading to - the name of the planet that 'moves slowly'. This is true of Saturn. *Shanaishchara* for Saturn stemmed out of Vedic terminology long before the Western astronomy evolved and discovered that the planet Saturn moved slower than the rest of the planets. The meaningful Vedic name of Saturn must have been a result of the astronomical observations by the

Vedic *rishis* year after year. The fact is that the illumination from this distant planet is not in abundance and therefore is weakly discernible with naked eyes. If it is assumed that the *rishis* did not have high-resolution telescopes then it would be difficult to detect the slow-moving, dimly lit Saturn amid many other brighter stars. Also it would be difficult to ascertain that it is a planet. But they did identify it correctly as *"shanaishchara"* and even named it *Shanaishchara* the "slow moving planet". This is only possible with persistent and consistent astronomical observations of the planet over lengthy time periods.

From several Purana references, Pundit Bhagvaddatta has listed other synonyms of the planet Saturn. They are: *Rudra, Sauor, Ark-putra, Chhaya-suta, Asit, Krod, Virup* and *Yama*. No doubt each of these carefully assigned names would reveal significant descriptive features of Saturn that may pique the interest of astronomers.

## Additional Comments on Planets

According to some modern Indian astronomers the next two planets after Saturn are ***Prajapati*** and ***Varun*** which respectively are Uranus and Neptune. This author feels that naming Uranus and Neptune as ***Prajapati*** and ***Varun*** is a recent astrological development owing to prevelent Puranic mythical following. The fact is that the term ***Prajapati*** in the Vedic vocabulary is for Nature as the material-cause of the creation and the term ***Prajapati*** is also for the Creator as the efficient-cause of the creation. The term ***Varun*** frequented in the Veda mantras stands for the Sun. This author has not been able to draw sufficient convincing research material from the Vedic Literature to comment on the last two planets.

To conclude this section the author presents a few relevant references:

- *Shukra* (Venus) and *Maata Prithvi* (Mother Earth) are mentioned respectively in two mantras of RigVeda (5/43/14, 15);

- '*The Su-Mangal (good-Mars) of copper complexion, beautiful with subdued-yellow colour..'*, is stated in YajurVeda (16/6);

- '*…the blue-surface Brihaspati* (Jupiter) *is worth investigating by brilliant scholars…*', states RigVeda (5/43/12) and

- *the Saturn's three rings are the subject of RigVeda mantra (5/43/13).*

Among the different objects of the solar system the long-term periodic visitors to the observed space of the solar system are the comets. Just a few words on comets from a Vedic perspective are in order.

## Comet: the *Dhoomketu*

The Vedic term for a comet is *dhoomketu*. The term *dhoomketu* is derived from *dhoom* and *ketu* which respectively mean 'smoke' and 'tail'. A *dhoomketu* therefore is '*one with a tail of smoke*' – a comet.

RigVeda (5/11/3) states – "… *dhoomaste ketuh abhavat divi shriah…*" This means - "*…your tail is made up of smoke and you are illuminated in Dyu region* (abode of the Sun)."

Another mantra in YajurVeda (33/2) states – "*Haryo dhoomketavo vaatjoota a-uup dyavi | yayante vrithak-agnayah*", translates into what the modern definition of a comet is. The word for word full translation of this mantra is: –

"*The struggle (yayante) of a dhoom-ketu is under the effect of attraction (harayo) and strong wind (vaat-joota), with*

*differing (vrithak) heat (agnayah) to illuminate (dyavi) it*. YajurVeda (33/2).

The physics of a comet being this beautifully depicted in the mantra poem is obviously a result of sage's deep knowledge of astronomy and physics.

Pundit Udaya Narayan Singh (cited earlier) in his translation of "Soorya Siddhant" has a short commentary on the comets which are listed in the ancient astronomy books. The valuable information from his book will benefit the reader. It seems this ancient list of *Dhoomketus* exceeds 1000 in number and that the list provides observational description of comets and their respective periods of occurrence, something similar to what we have in modern astronomy. The ancient writings state that the *Paitamah-ketu* (The Grand Father Comet) appears once every 500 years, the Uddalak-Shwet-ketu (Uddalak-white-tailed) appears once every 110 years and *Shulaagra-shikha Dhari Kashap-ketu* with pointed and thorny front and a tail, named after the observer, Rishi Kashap, appears once every 1500 years and so on. Such detailed data cannot be based on mere hearsay and casual observation. One needs knowledge in gravitational mechanics to assign periods to the comets. The *rishis* obviously possessed it.

An ancient Vedic astronomer Deval has mentioned 108 different comets in his "Deval Samhita". He classified them into 9 categories that he has named. "Parashar Samhita" has listed 101 comets. Compilation of over 100 comets by a single person is an extraordinary achievement. Included in his list is a comet named Uddaalik Shwetketu (Audalik with white tail) mentioned above. He described it in detail stating that '*it stays away for 110 years and then appears. And then appear others after it…"*. It could be any one of the long period comets listed in the modern astronomy tables such as the Bernard (119.67 years), Halley (75.32 years), de Vico (75.35 years) or Swift-Tuttle (133.28). What is impressive about the information in these ancient "Samhitas" is that along with the name of the comet the ancient astronomers have provided comet's description, periodicity, the time of the year and its position in the constellation. This author has not had the opportunity to read "Parashar" and other Samhitas mentioned by Pundit Udaya Narayan Singh. However, this author is very appreciative of Pundit Udaya Narayan Singh's very informative commentary on "Soorya Siddhant".

# Index

*a brisk dancer*, 494
***Aapah-Devata* and *Vaayu-Devata* in Einstein's Field Equations**, 570
Acharya Gyaneshvar ji, xvi
Acharya Udayaveer Shastri (1894-1991 CE), xvi
*Aditi*'s 8th child, 498
*aknopan*, 455, 511, 514, 566, 567
Aleksander Friedman in 1922, 424
ancient Greeks, 610
*antariksham*, 442, 443, 530, 531, 562
*Apaam-napaat* means the "*grand-son of Aapah*, 532
Apollo-11 flight (July 16, 1969), 701
**Appearance of Geometry, Mass and Gravitation**, 475
**Arrow Falling Under Gravity**, 677
Aryan Civilization, 550
Aryan Hypothesis, xiii
Aryan Invasion Theory, xiii
Aryavart, 445, 581
*Asata*-state, ix, 406, 407, 408, 409, 412, 413, 414, 415, 418, 420, 424, 428, 431, 432, 438, 440, 443, 444, 448, 453, 454, 457, 458, 459, 460, 461, 462, 466, 467, 469, 472, 473, 475, 480, 482, 485, 487, 489, 507, 511, 512, 517, 574, 580, 594, 597, 600, 604
*Asata*-state of matter, ix, 407, 413, 414, 438, 440, 443, 448, 462, 472, 480, 512, 574, 580, 594, 597, 600
**Astronomy Terms in the Mantras**, 612
Ayodhya, xii
Bhavavrittam Sukta, 401
Big Bang Hypothesis, ix, xi, 414, 415, 421, 423, 424, 425, 439, 443, 451, 454, 456, 459, 460, 461, 466, 469, 470, 481, 482, 489, 494, 500, 503, 506, 518, 519, 520, 527, 537, 540, 546, 554, 555, 559, 568, 569, 571, 574, 575, 576, 583, 587, 593, 595, 602
Birth of the Solar System, 609
**Bottom-up /Top-down Galaxy Theories**, 556
**Bottom-up** theories, 554
**Cause-Effect Principle**, 421
Comet, 714
Compact Hydrogen Universe, 464
Constellations, 615
Cosmic Inflation, ix, 453, 466, 481, 540, 546, 587
**Creation Energy Field**, 411
**Creation Force**, 411
**Creator-Entity (*Purush-tatva*)**, 416, 455
Curved Space near massive bodies, 589
Dark Energy, x, xii, 436, 456, 481, 503, 509, 520, 533, 541, 554, 559, 568, 569, 570, 571, 574, 575, 593
Dark Halo, 585

Dark Matter, 503, 505, 509, 554, 586, 587
**Darshans**, x, xii, xv, 405, 672, 673
*Devnagari* script, xi
**Direction of Rotation of the Universe**, 557
**dynamic stability**, 540, 566
Earth's Gravitation, 672
Edwin Hubble, 424
*eekshana* force, 675
*eekshana-munn* energy, 455
***Eight Progeny of Aditi***, 473, 483
exo-planet, 441
Expanding Universe - a Vedic Discovery Eons Ago, 546
Extinct Sarasvati River Project, xiii
**February 18, 3102 BCE**, x, xii, 509, 611, 619, 673, 681, 690
First Action of Aditi, 483
Flatness Problem, 579
**Force Transfer**, 561, 563
Furrows in Aapah Field, 587
Georges-Henri Lemaitre, 423, 424, 475
Gilbert (1893), 702, xxv
God's Particle, 478
Golden-embryo) **receives a spin**, 523
***gou***, 668, 669, 670, 671
**gravitational coupling**, 571
***gurutva*** (gravitation), xiii, 563, 676, 678, 681
Hartman (1966), 702, xxv
Hastinapur, xii
Hesiod, 610
Higgs Particle, 478
Himalaya, 681, 682
Hipparchus (190-120 BCE), 611, 625
*Hiranya-aand* (Golden-ovate), 460, 526, 568, 631
Hiranya-garbh, 424, 458, 469, 476, 477, 514, 519, 521, 523, 537, 629
Indra-devata - the Electricity, 480
*inherent angular momentum*, 518, 558, 565, 575
Jupiter the Dyu-pitar, 712
Kalhan, xii
Kali-Yuga Calendar, 625
Kaliyug-Calendar, xii
King Manu, xiv
Krishn, 461, 505
*Krishn* = black, 505
Krishna, 582, 673, 677
Latent Kinetic Energy, 454, 471, 472, 473, 532
**Linear and Rotational Kinetic Energy**, 459
**Lunar Age**, 703
Lunar Dynasty, xii
**Lunar Samples**, 701
Lunar Surface, 697, 705
*Maart-aand*, Mortal-ovate, 498

Manusmriti, x, xiv, 402, 442, 445, 446, 447, 448, 449, 450, 451, 457, 470, 614
mass distribution, 503
material-cause, ix, xi, xii, 408, 410, 411, 421, 425, 436, 438, 447, 455, 461, 481, 487, 600
Max Muller, xiii, 403
**Merger of Galaxies**, 555
**Metamorphosis of the Universe**, 539
Milky Way Galaxy, 430, 439, 464, 472, 494, 518, 521, 526, 538, 549, 550, 551, 555, 575, 584, 613, 627, 638, 639
Mirage of the Cosmos, 587
Mlodinow, 420
**Moon and Mercury**, 696, 697
**Moosal**, 674, 678
**Munn**, 417, 418, 419, 420, 421, 449, 455, 457, 459, 466, 474, 479, 480, 481, 502, 604, 662, 663
**Nature-entity (*Prakriti-tatva*)**, 582, 600
neutron, 465, 466
Newton, xiii, 672, 673, 677, 678, 679, 681
Nicolas Copernicus, 708
Nirukt, xi, xv, 403, 413, 427, 455, 485, 511, 532, 566, 567, 597, 611, 613, 617, 641, 642, 643, 650, 653, 655, 656, 660, 668, 669, 670, 671, 682, 683, 684, 685, 686
Observable Universe, 462, 503
**Origin of the Moon**, 684, 687
Oscillating Universe, 575
*paramanu*, 408
*paryaplav*), the rotational motion, 534
*paryaplav*-rotation, 547
*pishangila* = swallowing, 595
**planet Earth**, 530, 634, 641, 659, 663, 670
planet Jupiter, 707, 708, 710, 712
planet Mars, 706, 708
planet Mercury, 651, 696, 697
**planet Saturn**, 465, 713
**planet Venus**, 652, 655, 656, 658, 659, 707
**Practical Aspect of Devas**, 566
***Prajapati***, 401, 412, 423, 424, 425, 476, 477, 506, 510, 534, 549, 556, 558, 560, 565, 566, 574, 639, 642, 713
*pralaya*, xii, 404, 405, 408, 409, 410, 412, 413, 419, 432, 435, 436, 438, 444, 458, 461, 462, 469, 470, 498, 502, 516, 522, 538, 559, 571, 573, 574, 577, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 605
proton, 414, 429, 431, 439, 464, 465, 466, 468, 470, 472, 478, 480
Ptolemy (90-168 CE), 611, 625
Pundit Gurudatta Vidyarthi, xiii
Puranas, 651, 682, 689, 696
Quantum Mechanics, 402, 487
quark, 466, 471, 562
**Rain-drop falling under Gravity**, 680
Rajasthan, xv
Rajo-Guna - the Gravitation, 600
Ram, xii
Rishi Kanaad, xiii, 440, 459, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 683

Rishi Kapil, ix, 406, 444, 449, 470, 491, 492, 497, 603, 648
Rishi Vedvyas, 529, 619, 673, 681
Rishi Yask, xi, xv, 413, 455, 511, 516, 532, 567, 611, 613, 643, 653, 655, 656, 668, 669, 670, 682, 683, 685, 686
**Rotating One-wheel System**, 539
Rotating Universe, 518
**Rotation of Galaxies**, 554
Saankhya Darshan (Philosophy), ix
Sagan, ix
Sanskrit, x, xi, xii, xiii, xvi, 401, 403, 404, 405, 408, 413, 431, 445, 447, 469, 475, 487, 499, 502, 527, 528, 529, 532, 544, 567, 568, 574, 582, 597, 610, 611, 612, 615, 617, 621, 628, 631, 633, 640, 643, 644, 645, 646, 651, 652, 653, 656, 659, 661, 662, 663, 667, 668, 670, 673, 677, 680, 681, 686, 696, 709, 712
*saptaarth-garbha*, 509
*Sata*-state, ix, 405, 406, 407, 408, 409, 413, 414, 419, 424, 428, 431, 432, 437, 438, 443, 448, 453, 454, 457, 460, 462, 467, 471, 473, 475, 480, 482, 484, 485, 489, 493, 507, 511, 512, 517, 563, 567, 594, 604
*Sata*-state of matter, ix, 405, 407, 409, 414, 428, 443, 454, 468, 471, 512, 567, 594
*sato-guna*, *rajo-guna* and *tamo-guna*, 600
Seven Primary Vedic Devas, 500
Shaakpooni, 511, 566
**Shape of the Earth**, 662
Shape of the Universe, 578
Shatpath Brahmana, xv, 453, 460, 476, 488, 509, 510, 514, 515, 516, 528, 534, 541, 556, 568, 577, 627, 629, 655, 684, 690, 691, 692, 693, 694, 695, 705, 706, 711
Skambha, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 536, 538, 540, 541, 545, 549, 550, 551, 560, 564, 566, 569, 571, 573, 575, 580, 582, 583, 584, 587, 598, 662
Skambha the Pillar of Energy, 521, 549
Smritis, x, xv, 517
**Solar Rays**, 647, 685
**Solar System**, 627, 628, 645, 661
*Soorya* Siddhant, 610, 611, 619, 622, 623, 625, 639, 708, 709, 714, 715
**Soul-entity (*Atm-tatva*)**, 418
space-time singularity, ix, 408, 413, 414, 415, 423, 425, 438, 453, 458, 460, 462, 475, 481, 518, 527, 540, 555
Steinhardt, x, 425
Sthaulashttheevi, 455, 566
Sun Dynasty, xii
Swami Dayanand Sarasvati (1825-1883 CE), xi, xv
Synonyms of Prithvi (Earth), 660
The Devas, 427
**The Moon**, 683, 684, 685, 688, 690, 695
the Vedic Big Crunch, 593, 603
Three Motions of the Earth, 667
**Time Division of 4.32 BY**, 445
**Top-down** theories, 520, 554
**Tri-property *Aapah* Particles**, 406
True Absolute Zero Temperature, 454, 459, 469, 470, 472, 473, 476, 606
Tuchchhaya versus Colossal, 462

***tuchchhayen***, 411, 413, 414, 423, 439, 460
Tug-of-War, 559, 579
**Two Opposing Real Forces**, 559, 579
Ujjain, 625
**Universe like a Tree**, 581
Upanishads, x, xv
Urey (1951), 702, xxvi
***Vaayu* the *Devata* of Expansion**, 576
Vaisheshik Darshan, xiii, 672, 673, 674, 679
Vanprasth Ashram of Rojad, Gujarat, xvi
*varootham* which translates into '*cluster of atoms*', 597
Vedic astronomy, 610, 611, 615, 618, 622, 624, 625, 635, 652, 656, 706, 707, 708, 710
Vedic Big Bang, vi, ix, x, xiv, 413, 414, 423, 424, 436, 451, 453, 454, 455, 459, 460, 470, 481, 485, 498, 499, 500, 501, 511, 514, 518, 520, 526, 527, 533, 534, 536, 538, 539, 540, 546, 551, 555, 556, 558, 559, 566, 567, 574, 575, 584, 609, 629
Vedic Civilization, xii, 530, 646
Vedic Cosmology, ix, xi, xiv, 401, 402, 404, 407, 415, 433, 436, 438, 439, 444, 445, 451, 452, 454, 456, 459, 472, 475, 479, 487, 489, 490, 494, 499, 500, 506, 507, 514, 520, 528, 533, 540, 546, 549, 550, 579, 595, 603, 609
Vedic Cosmology Scenario, ix, x, xiv, 546, 609
Vedic Creation Principle, 401, 402, 403, 410, 416, 420, 421, 461, 499, 514, 517, 531, 629
Vedic Literature, x, xii, xiii, xv, xvii, 403, 404, 407, 410, 413, 439, 448, 454, 477, 500, 514, 517, 537, 578, 580, 582, 594, 614, 623, 648, 649, 651, 652, 655, 680, 684, 687, 689, 696, 705, 706, 708, 713
Vedic Nakshatras, 615, 623
Vedic Philosophy, xi, xv, 447, 579
**Vedic Triune Atom**, 408, 600
*vyavartayat),* the spin, 522
*yagjya* (fire oblation), 568
Yudhishthir, xii, 673
Λ-CDM (Lambda – CDM) model, 554
**रश्मि** (*rashmi*), 536
**हिरण्मयमाण्डं** (*hiranmayam-aandam*), ix

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# Limited List of Vedic Terms often cited in the Book

| | |
|---|---|
| *Aapah* | An all-pervading tri-property fundamental state of matter |
| *aatma, atman* | soul |
| *acharya* | Teacher and scholar of high calibre |
| *Antariksh, Aakaash* | Space-entity, container of matter/energy of the universe, varies with eternal existence |
| *anaadi* | Entity without beginning, eternal |
| *Asata-state* | state of matter devoid of matter properties, indefinable matter state confined in diminutive space |
| *avi-vritsan* | (अविवृत्सन् ): repetitive circular motion as in the orbital motion of a planet |
| *avyakta* | indescribable |
| *bhuta* | matter/energy, *bhutaani* (plural of bhuta, includes all matter in both realms: animate and inanimate. *panch-maha-bhootas* (five-major-elements of philosophy) |
| *chakraprasaran* | represents two actions together: rotating around an axis and spreading radially keeping its circular shape |
| *Brahmn* | The Creator, purush - one who pervades all (details in Chapter 5) |
| *chakra* | wheel, an orbiting system |
| *chakrampari* | Circular motion on a perimeter as in an orbiting celestial body |
| *darshan* | phylosophy |
| *deva, devata* | One with brilliant properties – a conscious-being or inert system of Nature essential to sustain creation |
| *dhoorshu* | (धूर्षु ): In the axis of rotation |
| *hiranmayam-* | (हिरण्मयमाण्डं): hiranya-garbh, hiranyand, golden- |

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| *aandam* | embryo, primordial ovate/spheroid of Nature (matter), spheroid with golden brilliance |
| *Inddraprasth,* | Hastinapur, Ancient names of the capital now Delhi |
| *Kaalah, kaal* | Time-entity (irreversible) |
| *kali-yuga* | Time period of 432,000 yrs |
| *kaaran* | cause: nimitta-kaaran (efficient-cause), upaadaan-kaaran (material-cause), saadhaaran-kaaran (ordinary-cause) |
| *kaarya* | effect, action, karma |
| *Krishn or Krishna,* | or *Shree Krishn, Yogiraj Krishn*: All names of Lord Krishn who delivered the message of Bhagvadgita to Arjun |
| *maatali* | cosmologist, a sage with specific knowledge of creation, space, time and cosmos |
| *Mahabharata* | War between Kauravas and Pandavas near 3,140 BCE, an epic book |
| *mantra* | A metered poetic couplet |
| *Manu, Manusmriti* | Manu the first ancient king of Aryans who wrote the book of Manusmriti |
| *Munn* | Mind-entity |
| *Nirukt* | Book by ancient Rishi Yask |
| *nitya* | ever-existing |
| *parmaanu* | fundamental particles of matter indivisible further, round in shape |
| *pari-kraman* | defines the 'step-wise motion on a circle' |
| *Prajapati* | Nature the master of cosmos (material realm), God as the master of all cosmos (spiritual context) |
| *Prakriti* | Nature |
| *pralaya* | dissolution of creation |
| *paryaplavan* | large scale circular rotation around an axis of a system in floatation as in hurricane |

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| *rishi* | a highly enlightened person, revealer of Veda mantras and the hidden meaning in them |
| *Sarasvati* | a multi-meaning word: intellect, ancient extinct river, title for a Vedic scholar of high calibre |
| *Sata-state* | real definable matter, the state of matter to form universe |
| *sato-guna, rajo-guna* and *tamo-guna* | fundamental *aapah* particle made up of three different particles with three properties (*guna*) (details in Chapter 5) |
| *Sanskrit* | A highly developed, grammar-rich ancient language, the language of the Vedas |
| *skambha* | Pillar, support of the universe (Creator, physical structure of matter and energy at universe centre |
| *sneha* | property of bonding matter or living-beings |
| *srishti* | Creation, one that does not happen by accident |
| *sukta* | group of mantras with common theme, a hymn, section of a chapter |
| *Sutra* | treatise, a book of philosophy |
| *sutra* | an aphorism, a principle |
| *swami* | master, highly revered person, a monk |
| *tatva* | substance with real existence, entity |
| *tuchchhaya* | space holding universe in dissolution phase in diminutive space when matter is in devoid of dynamics and properties |
| *urmim* | vibrations or waves |
| *Vedas* | The books of knowledge, four Vedas are RigVeda, YajurVeda, SaamVeda and AtharvaVeda |
| *varootham* | Cluster of atoms (a cosmic objects) |
| *vitatah* | (वितत: ): instantaneous expansion as in an explosion |
| *yojan* | Ancient unit of distance (1 yojan = 13 km) |
| *Yudhishthir, Arjun* | Two of five Pandava brothers in Mahabharata |

# About the Book

Could there be another rational cosmology theory elsewhere in another civilization before the modern Big Bang was conceived by Georges-Henri Lemaitre in 1927 CE. Yes there is. It literally exists since antiquity, in 'chapter-and-verse', in the book of RigVeda, encased in eons old mantra formulations under the heading of *Bhavavrittam* which means "*The History of Creation of the Universe*". The author, Dr. Shiv Raj Pal a physicist, named the process the "Vedic Big Bang" because the universe in Vedic Cosmology begins with an impetuous explosion in the enormous primordial matter ovate termed *Hiranya-aand* (brilliantly hot Golden-spheroid). It is amazing that these two cosmologies, eons apart, are similar in some aspects and different in others. The uniqueness of the Vedic Big Bang is that a colossal rotating central bar (pillar) of matter/energy initiates the Big Bang and sustains the universe in perpetual rotation and expansion in which the matter, energy and all processes are real and none hypothetical such as the hypothetical Cosmic Inflation and Dark Energy of the modern Big Bang.

The Vedic definitions of Time, Space and Nature (matter, energy) are superior and detailed. The Vedic Cosmology Scenario is followed by the Vedic theory of the formation of the solar system revealing intriguing features of the planets. The book takes the reader to India's historical period anterior to 5,000 years when the rich Vedic Literature developed. Mind-boggling deductions from the mantras indicate an incredibly elevated thought-system prevailing in the Vedas. Prepare for an illuminating voyage to the beginning of the cosmos.

# About the Author

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Dr. Shiv Raj Pal was born and brought up in a small farming village in the State of Rajasthan, India. He completed BSc and MSc (Physics) from Rajasthan University and the PhD from the Physical Research Laboratory (PRL)/Gujarat University. The National Research Council of Canada awarded him a Post-doctoral Fellowship to carry out research at the Environment Canada in the subject of Twilight Scattering. The author joined the Physics Department, York University in 1972. Research work at York University included the Remote Sensing studies of aerosols, clouds, ozone layers at Toronto and in the Canadian High Arctic at Eureka in Elsmere Islands employing powerful LIDARS (Laser Radars). Serving as the in-charge of the LIDAR Laboratory the author participated in several international LIDAR missions.

Dr. Pal has published a good number of peer-reviewed research papers in physics journals, presented papers at conferences and published in conference proceedings and produced a large number of research reports. For more information please read author's website www.VedicBigBang.com,

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# AN AMAZING BOOK ON ANCIENT COSMOLOGY WITHIN THE REFERENCE FRAME OF PHYSICS.

## THE VEDIC BIG BANG © A New Cosmology Scenario Revealed in the Ancient Veda Mantras of India.

1. Could there be another rational cosmology theory elsewhere in another civilization before the modern Big Bang hypothesis was conceived by Georges-Henri Lemaitre in 1927 CE? Yes there is, with 'chapter-and-verse' in mantra formulations of the Vedas, the ancient "*books of knowledge*" of the Aryans (Hindus) of India.

2. Professor Carl Sagan once recited the English translation of a Veda mantra and remarked, "*Most sophisticated ancient cosmological ideas came from India*". This book validates his deduction.

3. The reader will be delighted to witness the fascinating ancient, previously unheard of, processes and objects of cosmology/physics. The Vedic advent of the universe is with a *vitatah* (impetuous expansion) in the primordial Nature (matter) in the shape of a Golden-ovate at extreme high temperatures and in *paryaplav* (rotation in floatation) for a prescribed period of one *deva-yuga* measuring 4.32 million years (RigVeda, 10/72/9, Shatpath Brahmana, 11/1/6/1, 2). The fragments of the Golden-ovate form the cosmos. This is THE VEDIC BIG BANG!

4. The book is critical of the modern Big Bang Hypothesis that all matter of the universe, $10^{60}$ kg (60 zeros after 1), came "out of nothing" - the dimensionless "space-time singularity". In contrast the ancient sage Kapil, in his Saankhya Philosophy stated नावस्तुनो वस्तुसिध्दि (*Naavastuno vastusiddhi*), meaning - "*Nothingness cannot be the cause of something*" (1/43) and a Vedic dictum states: "*What is being created cannot be a cause of itself*".

5. The statements of Professor Hawking and his co-author Professor Mlodinow that "*Universe can and will create itself from nothing*" and "*... You can have nothingness in quantum theory. But from that, things will arise*" violate Nature's all-pervading law of "cause-and-effect". In the advent of the cyclic Vedic universe the pre-existent indefinable *Asata*-state of matter transits into the definable *Sata*-state of matter (RigVeda, 10/129/1), with all matter accounted for.

6. In the Vedic Big Bang the rotating golden-ovate creates a rotating universe with the centrifugal force pointing outwards causing the expansion of the universe.

7. The "Expanding Universe" is a Vedic discovery from eons ago (RigVeda, 10/56/5), which is elucidated in this book entitled — "The Vedic Big Bang". No hypothetical "Dark Energy" or the hypothetical "Cosmic Inflation" of the modern BIG BANG Hypothesis is necessary.